LIBRARY OF CONGRESS
FEB 4 1891
SMITHSONIAN DEPOSIT

THE AMERICAN

GAS LIGHT JOURNAL

BLOMANN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LIV.—No. 5. Whole No. 817. | NEW YORK, MONDAY, FEBRUARY 2, 1891. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y. AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, N.Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C.O.D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—
New England Association of Gas Engineers..... 145
Annual Meeting of the Southwestern Association..... 145

EDITORIALS—
Obituary—William Mooney..... 146
Briefly Told..... 146
An Error—Notes—Public Lighting—Public Lighting, Montclair, N. J.
Chemical Studies for Gas Engineers, No. III., by Norton H. Humphrys, A. M. Inst. C. E., etc..... 147
Presidential Address, Annual Meeting (1890) Southwestern Gas Association, by Mr. Wm. Enfield..... 148
Freezing Machines Shown at the Paris Exhibition..... 150
Gas as a Source of Light, Heat and Power, by Mr. Wm. Enfield.... 151
Fire Resisting Construction..... 151
Special English Correspondence..... 153
The Weather—Prof. Lewes, on Gaseous Illuminants—The Chemistry (?) of the *British Medical Journal*—Labor Strikes—The Sulphate Market.
Gas and Electricity..... 154

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 155
Annual Meeting, Evansville, Ind.—And at Paducah, Ky.—San Francisco Gas Rates—Progress of the Berlin Iron Bridge Company—Annual Meeting, Selma, Ala.—Mayor Pat. Gleason's Latest Move—Damage Suit—Receiver for the Americus (Ga.) Works—Annual Meeting, Manchester, N. H.—Cheaper Gas for Allentown, Pa.—Will Pittsburgh (Pa.) Follow the example of Allegheny City—Testing the Candle Power of Arc Lights at Warren, O.—A Generous Act—Dr. Baxter Gets a Verdict—Annual Meeting, Warsaw, N. Y.—The Equity Company, of Brooklyn, to go Ahead—Annual Meeting, Houston, Texas—New Gas Inspector for Louisville, Ky.—War of Rates, Rochester, N. Y.—And Many other Items.
The Market for Gas Securities..... 157

[OFFICIAL NOTICE.]

New England Association of Gas Engineers.

SECRETARY'S OFFICE, BIRMINGHAM, CONN., Jan. 15, 1891.

To the Members of the New England Association of Gas Engineers:—

The meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, Mass., on Feb. 18 and 19, 1891. The meeting will be called to order by the President, Mr. C. F. Prichard, on Wednesday, at 10 o'clock A.M.

It is hoped that all the members who can possibly attend will be present. As yet it is too early to give a list of papers which will be read, but it is believed that the coming meeting will prove no exception in this respect to those which have been held in the past, and that in the course of two weeks the announcement can be made of a goodly number of papers.

Persons eligible for membership and wishing to join the Association will please send to the Secretary for blank forms of application.

CHARLES H. NETTLETON, Secretary.

[OFFICIAL NOTICE.]

Annual Meeting of the Southwestern Gas Association.

SOUTHWESTERN GAS ASSOCIATION,
DENISON, TEX., Jan. 5, 1891.

We herewith hand you a programme of the next meeting of the Southwestern Gas Association, to be held at San Antonio, Tex., on the 10th and 11th days of next March. The officials of the San Antonio Gas Company have expressed a willingness to provide accommodations for all attendants at our next meeting. You can communicate direct with them. You will please bear in mind the knowledge to be derived from the discussions from the papers to be read at these meetings. We expect a good attendance, and must have you with us. Do not fail to come. Our Question-Box is open for your queries. Information can be had through it that can be received through no other channels. Trusting to be favored with your presence, we are,

Yours fraternally, WM. ENFIELD,
J. R. CULLINANE,
Committee on Programme.

Programme.

Address of President, A. E. Judge, Austin, Tex.

"Advantages of a Gas Engineer Being a Member of a Gas Association," by the President.

"Gas Coals of the Southwest," by Wm. Enfield, Dallas, Tex.

"Condensation and Leakage in the Southwest," by C. P. Russell, Galveston, Tex.

"Regenerative Furnaces in the Southwest," by E. A. West, San Antonio, Tex.

"The Steam Jet Exhauster and Condensation," by J. C. Lord, Fort Worth, Tex.

"Candle Power in Competition with Electric Lighting," by Leonard Gill, Corsicana, Tex.

"Electric Lighting in Connection with Gas Lighting: Comparative Prices and Profits of Each," by J. J. Walsh, Paris, Tex.

"Fuel Gas and Gas for Fuel," by J. R. Cullinane, Denison, Tex.

"Gas Making in the Southwest: Its Advantages and Disadvantages," by Joshua Gill, Houston, Tex.

"Market for Residuals in the Southwest," by J. L. Brockenborough, Waco, Tex.

"The Commercial Possibilities of Gas," by Thos. Miller, Fort Worth, Tex.

"The Gas Man's Easy Chair: Has he One?" by Maj. Davis, Sherman, Tex.

"Mains, Services and Drips," by Elmer Jones, Paris, Tex.

"Gas Stoves and a Special Price for Gas as Fuel," by G. R. Vaughn, Houston, Tex.

"The Alternating Current," by J. H. Maxon, Waco, Tex.

"Carrying Gas into Mexico and to Mexicans," by M. L. Hickey, El Paso, Tex.

OBITUARY.—WILLIAM MOONEY.

Our issue for last week contained a brief notice of the shockingly sudden death of Mr. William Mooney, whose demise occured at noon of January 21st, in the National Hotel, Peoria, Ills. The original despatches stated that Mr. Mooney died in the rotunda of the hotel, but this was in error; and in order to show that it was we give the following facts respecting his death: Deceased, who had been retained by the Peoria (Ills.) Gas Light Company to design certain improvements on its works and in its apparatus, arrived in Peoria at 8 o'clock A. M., of January 21st, and went to the office of the Company, where he remained until 9 o'clock, going from thence to the works to meet Superintendent Coffey. Together they compared notes and made inspection as to the progress of the improvement work, and separated at 11 o'clock. Mr. Mooney going back to the hotel, after agreeing to again meet Mr. Coffey at 1 o'clock. Mr. Mooney complained that the railroad journey seemed to have upset him somewhat, but did not in any sense speak seriously of his condition. Arriving at his hotel he returned to his room, and shortly afterward a chambermaid, in passing the room, was alarmed at the sound of sterterous breathing. She opened the door to find the occupant of the room evidently in a serious state, and at once informed the hotel proprietor. Dr. Kerr was summoned, but all that his skill could do was powerless to save the sufferer, who passed quietly away, in an hour or so from the time of the Doctor's arrival.

William Mooney, who was the son of William Mooney and Mary Thorp, was born in New York city, on October 6th, 1838, and was the great grandson of William Mooney, the latter having been the prime mover in the organization of what is now known as the Society of Tammany Hall, but which was originally called the Tammanial Society, or the Society of Columbia. Left an orphan in his second year, young Mooney was raised by an aunt who lived in Connecticut, from which circumstance no doubt came the error in the local obituary notices that deceased was born in that State. His earlier studies were completed in a boarding school at West Bloomfield, N. J., and from thence he entered the office of one of New York's noted architects—Mr. John B. Snook—and served out a regular apprenticeship. Fellow apprentices in Snook's office at that time were Carl Phiefer and "Deacon" Hatch. We next find him as an employee in the office of the separate establishment set up by Carl Phiefer, and from there he took service with the Oregon Iron Foundry, of Messrs. Herring & Floyd. It was there, likely, that his first practical knowledge of gas works construction was gained, and the Oregon Company's clientele brought him in close contact with the prominent gas engineers of the day. Later on he entered the office of Mr. William Farmer—when that Engineer resigned from the staff of the Manhattan Company to enter extensively in the general field of gas works designing and construction—and remained with him as his chief man until the retirement of Mr. Farmer from active business. Mr. Mooney succeeded to Mr. Farmer's business. It was during this period—say from 1873 to 1885—that Mr. Farmer was concerned in the reconstruction of many notable gas plants, and the construction of new ones. In the former division might be noted the Mobile, Ala., and the Cincinnati, Ohio, works; and in the latter a prominent example is found in the Laclede works, at St. Louis. Mr. Mooney's special aptitude as an adapter and his skill as a draughtsman had wide scope in Mr. Farmer's business, and his time and talent were devoted freely and successfully to its development. Deceased subsequently managed with discretion and tact that business when he succeeded to it, but the times had changed and the methods of gas works builders and contractors were no longer those of a decade ago. By which is meant that the strictly independent gas works designer and draughtsman had not in the new order as many opportunities for retainers as the older order afforded him. In other words, builders now furnished plans, designs, and figures. Many of the important works in this country bristle with mute though eloquent testimony to his deftness, and it would not be very wide of the truth to say that his mark was made in every State of the Union.

He was elected a member of the Society of Gas Lighting in May, 1882, and was a frequent contributor of papers at its meetings. He joined the American Association on the occasion of the New York meeting, October, 1887, and since then his was a familiar figure at its annual gatherings.

Apart from his ability and genius as a designer and a draughtsman, deceased displayed the fertility of his mind as an author. To him is the profession indebted for the "American Gas Engineer and Superintendent's Handbook," published in 1888, and dedicated to the Society of Gas Lighting. He was a frequent and welcome contributor to the JOURNAL, and his articles were readable and valuable.

Many minor mechanical devices, particularly in respect to the construction and operation of gasholders, are traceable to him, but which cannot be claimed now with authority for him, as he failed to obtain the official seal for such improvements that are afforded in letters patent.

At the outbreak of the war, the regiment of which he was a member (the 71st New York State, Colonel Vosburgh) was called to the front, and in their 3 months' service took part in the first battle of Bull Run. Again (in 1862), he served his country as a member of the New York State Corps of Engineers, remaining with them to the end of the war. He retired from the service with the brevet of a lieutenant.

He was married in 1868 to Miss Clara Cox, who survives, together with a son and two daughters. The funeral services were celebrated at his late home in Plainfield, N. J., on the afternoon of Sunday, January 25th. The Society of Gas Lighting was represented by many of its members.

Personally, deceased was of the sort who make friends and keep them. Sincere and outspoken, malice had no part in his motives, nor did self-interest color his opinions; and in his death the fraternity are called upon to sorrow over the loss of an upright, conscientious brother.

In connection with the sad office of caring for the feelings of the living by seeing to it that the dead are properly prepared, the officers of the Peoria Gas Light Company are entitled to all possible praise for the manner in which they carried out the task so shockingly put upon them.

BRIEFLY TOLD.

AN ERROR.—In our initial notice (January 19, 1891) of the coming annual meeting of the Southwestern Gas Association, we unwittingly conveyed the impression that Mr. James R. Cullinane, of Denison, Texas, was the Secretary of the Association. While that gentleman undoubtedly would amply fill the bill in respect to Secretarial ability, the fact is that Mr. C. P. Russell, of Galveston, Texas, is the Association's Secretary, and that he will be heard from speedily in connection with the meeting. In connection with the convention, we may say that the headquarters are to be at the Hotel Menger, in which San Antonio justly takes pride as a hotel of the first-class.

NOTES.—A cable dispatch to Messrs. Schleicher, Schumm & Co., of Philadelphia, dated January 26th, shows that Dr. Nicholas August Otto, inventor of the Otto gas engine, died at Cologne, Germany, on the 26th ult.—At the annual meeting of the Brookline (Mass.) Gas Company, the only change made was the election of Mr. Harcourt Amory to be Treasurer, vice F. W. Lawrence, resigned. The Company voted to remove its works to a site on the Charles river. The reports show an increase of 12 per cent. in the gas output. The output of electric currents amounts in value to one-fourth of the Company's business.—The Cleburne (Texas) Ice, Light and Water Company has been organized with a capital of $50,000.—Mr. James Ball, of Philadelphia, acting for a syndicate, recently purchased 799 shares of stock in the Cape May (N. J.) Gas Company. This secures control. The stock was disposed of at Sheriff's sale.

THE Montclair (N. J.) Gas and Water Company's contract for the public lighting of Bloomfield Township expired yesterday. In the meantime the Company has expressed its willingness to enter into a new contract under which it will maintain any desired number of gas lamps, from dusk until 11:30 of each night in the month, at the rate of $13.50 per lamp per annum. Or, if it were preferred to keep the lamps alight until 1 a. m.; the cost thereof would be $17.50 per annum. It is likely the authorities will order that the lamps be kept alight until 12:30.

[Prepared for the JOURNAL.]

[NUMBER III.]

Chemical Studies for Gas Engineers.

By NORTON H. HUMPHRYS, Assoc. M. Inst., C.E., F.C.S.

We now direct attention to the examination of a sample of coal. Having carefully attended to the directions given on the matter of sampling, we collect a fair average sample of the coal, and crush it to a coarse powder. This having been well mixed, a portion of about 400 grains is taken and ground as finely as possible in an iron mortar. A small basin of glass or porcelain, perfectly flat-bottomed and about 2 inches in diameter, is carefully weighed (the weight may be marked on it once for all with the writing diamond), and we will suppose it to weigh 393.1 grains. We then put 100 grains of the finely-ground coal into it, which may be done by placing 493.1 grains in the opposite scale pan, and gradually adding powdered coal, by means of a steel spatula, to the basin until an exact counterpoise is obtained. The drying oven having been adjusted to a temperature of 200°, the basin with its contents is placed therein. After about 1½ hours the basin is taken out, cooled in a desiccator, and weighed. The desiccator consists of a glass shade with ground edge, standing on a glass base plate. A small dish or basin containing chloride of calcium or pure sulphuric acid is placed under the shade, together with a suitable support for basins, crucibles, etc., the object being to allow any vessel to be cooled without risk of absorbing moisture from the atmosphere. The basin must be weighed immediately after being taken from the desiccator, and with as much despatch as possible; and in the case of substances which rapidly absorb moisture from the air, the basin should be covered with a disc of ground glass, the weight of which has been ascertained.

The result of the weighing having been written down, the basin is returned to the drying oven for another half hour, after which a second weighing is taken. If the results of the two agree fairly well, then the operation is considered to be complete; but if there is an appreciable difference the substance must be again returned to the drying oven, and kept there till all moisture is displaced.

With the coal, if it is fairly dry and has been preserved under cover, we shall get a result something like this:

Weight at commencement	493.1 grs.
" after 90 minutes' drying	491.6 "
" after 30 minutes' drying	491.5 "

The loss by drying is therefore 493.1 — 491.5 = 1.6 grs., or 1.6 per cent.

Next take a platinum crucible with cover, the weight of which is known, and charge it in the manner above indicated with 25 grains of coal. The crucible may be ¾ in. diameter and 1½ in. deep. Place the cover on a little askew, so as to leave a narrow slit between the vessel and the cover at one side. Support the crucible over a Bunsen burner by means of a triangle of platinum wire, which may be formed by taking a ring of the retort stand, say 2 inches in diameter, and stretching the wire segmentally inside the ring. The supports for a crucible must always be of the lightest possible character, so as to avoid loss of heat by conduction, and to leave it open to the full force of the flame. A crucible supported in a thick iron ring, for instance, will not be evenly heated.

The flame of the Bunsen burner is to be gradually applied to the crucible, with a view of driving off the volatile products. Care must be taken not to hurry the operation, and if properly conducted they will steadily escape and burn with a luminous flame at the cover. As soon as the flame flags increase the heat, until at last the vessel is raised to a full and strong red heat. Watch for the cessation of the flame, indicating that the volatile matters have all passed off, and continue the full heat for exactly one minute after this point is reached. Remove the crucible to the desiccator, cool, and weigh.

Usually a little carbonaceous matter will be found inside the cover. This really belongs to the volatile portion, and its weight may be ascertained by weighing the cover as it is, and again after carefully cleaning off, the difference showing the weight of the deposited matter. The coal will have been converted into a mass of coke, and increased considerably in bulk. The object of the careful, gradual heating is to avoid undue intumescing and swelling, as, if the coal rises too much, it may lift the cover and spoil the experiment.

Take the crucible after weighing, and place it on the triangle in an inclined position, and also uncovered, so as to allow the fullest possible access of air to the coke. Apply the full heat of the Bunsen burner, and maintain it until there is no further loss of weight. The residue is a very fine, light powder, perfectly free from black specks, and will be white, yellow, brown, red, etc., according to the kind of coal used. Some coals require several hours' heating in order to burn off all the carbon, and the operation may be facilitated by stirring, as soon as it is sufficiently friable, with a platinum wire.

When the operation is complete, cool under the desiccator, and weigh with the cover on. We shall thus collect data such as the following:

(1) Weight of crucible	260.0 grs.
(2) Weight of crucible and coal	285.0 "
(3) Weight of crucible and coal after expelling volatile matter	277.4 "
(4) Weight of crucible after burning off carbon	260.7 "

Deducting (3) from (2), the weight of the volatile matter comes out as 7.6 grs. (which includes the carbon remaining in the cover). It must be remembered that this includes moisture. (4) deducted from (3) gives us the non-volatile carbon, 16.7 grs.; and (1) deducted from (4), the ash, 0.7 grs. These results are easily put into percentages, as follows:

Volatile matter	30.4	Water	1.6
		Gases, etc	28.8
Coke	69.6	Carbon	66.8
		Ash	2.8
	100.0		100.0

The student will do well to repeat these experiments upon as many kinds of coal as he can obtain satisfactory samples. The procedure as regards heating for dispelling volatile matters should be scrupulously similar, so as to expose each sample under exactly similar circumstances. He will thus obtain a useful insight into the properties of coals.

The quality of a coal is indicated by the proportion of ash and water present, both of which are worse than useless to the gas maker. It usually happens that the larger the proportion of volatile matter the better is the yield of gas. The ash should be preserved in small glass tube bottles, carefully labeled, as a collection of such ash is very useful as a reference in determining the locality from which a sample is sent, or for checking the genuine quality of a suspected cargo.

Samples of coke may be examined for moisture, fixed carbon, and ash, in the manner above indicated, and the results so obtained are very useful for purchasers or users of coke. Sometimes a slight trace of volatile matter will be displaced by heating in the closed crucible, but if the carbonization has been thorough all this will have been driven off in the retort. Samples of wood or other solid gas yielding materials may also be thus tested, the indications of percentage of moisture and of ash being especially useful from a practical point of view.

The quantitative determination of ammonia, either in the ammoniacal liquor or in the gas, is of importance. As regards the first, it constitutes a means of valuing the liquor; and with respect to the second, a test of the ammonia in the crude gas tells us how much there is to recover, whilst the gas at the inlet of the purifiers should be examined in order to make sure that the whole of the ammonia has been removed.

As the proportion of ammonia varies from time to time, it will not do to place reliance upon a single test. At least half a dozen should be taken at different times; and this holds good with regard to almost all experiments with gases in a practical way. A little research as to the efficiency of the various scrubbers, washers, etc., used on the works, by tests for ammonia at the inlet and outlet respectively, will afford a clear insight into the efficiency of the various pieces of apparatus.

Some standard solutions of sodium carbonate, ammonia, and hydrochloric acid will be required. The first-named is merely a standard for gauging the correct strength of the others. Get some pure sodium carbonate, free from excess of carbonic acid, and expose a portion to a dull red heat in the platinum crucible for a few minutes. An excess of heat will vitrify or fuse the carbonate, and this must be avoided. Having cooled the crucible under the desiccator, weigh out as rapidly as possible 53 grains. This may be effected by taking 54 or 55 grains in the first place, and removing the excess with a small spatula or knife blade until exactly 53 grains remain. Carefully transfer the 53 grains to a test mixer, which consists of a very narrow and tall stoppered bottle with a wide foot, made perfectly cylindrical, and graduated to contain 10,000 grains of water (¼th of a gallon), in 100 divisions. Rinse out every particle from the crucible by means of successive small portions of distilled water, and fill up with distilled water to about the 68th division. Agitate the bottle until the carbonate is completely dissolved. Then, taking care that the temperature of the room in which the operation is being conducted is not far from 60°, carefully make up the solution exactly to the 70th division. The liquid must then be well shaken for at least ten minutes.

Most people seem to fancy that liquids have a knack of mixing them-

selves; but while this may be true to a certain extent, it must be remembered that intimate and homogeneous mixture is not attained except by prolonged agitation—about as much mixing up, in fact, as we should give to a powder.

Having transferred this liquid to a labeled stoppered bottle, marked—

"*Standard Sodium Carbonate*, 1°,"
"53 grs. to $\frac{1}{10}$th gallon,"

and carefully washed out the test mixer, we take the hydrochloric acid, which must be pure, but need not necessarily be the strongest solution obtainable. Measure out 50 septems, which is equal to 3.5 divisions in the test mixer, fill up with distilled water to about 49 septems, and mix. Then make up to 52 septems, and thoroughly mix. Charge a 100 septem burette with about 30 septems of the liquid. Take 100 septems of the sodium carbonate solution in a small beaker, add a few drops of tincture of litmus, and allow the acid to fall, drop by drop, into it. As soon as the blue color of the litmus changes to a dark wine-red, remove the beaker to a stand over a Bunsen burner, and raise to boiling heat. The liquid should be well stirred with a glass rod after each addition of acid. The result of the boiling will be a re-appearance of the blue color. A few drops more acid must then be added, and so on until a bright red color that does not change on boiling is obtained.

A little practice is necessary to perform this successfully, as we must avoid even a drop of acid in excess. It is a good plan to take two distinct testings, the results of which should agree.

We thus arrive at the quantity of the acid that is equal to 50° strength. Suppose it turns out to be 8.2 septems. The strength of the hydrochloric acid solution is, therefore, 50 divided by $8.2 = 6.01°$. From this we can prepare a weaker solution of any strength required by diluting in proportion. It will be well to provide ourselves with two—a 1° and a 5°. To prepare the first, measure out 15 divisions into another test mixer. Since this represents $15 \times 6.01 = 90.15$, we have only to make up with distilled water to 90.15 divisions. The decimals may be ignored for our purpose; but if strict accuracy is wished, add 2 septems of distilled water after filling up to the 90th mark. These may be measured in from a small graduated pipette, or from a burette. Thoroughly mix, and test again with the sodium carbonate. Twenty septems of acid should neutralize exactly 20 septems of the carbonate. No test solution should be bottled for use without first checking its accuracy. Transfer the solution to a labeled stoppered bottle marked—

"*Hydrochloric Acid*, 1°."

There are about 36 divisions of the 6.01 solution remaining in the test mixer. This would be equal to $36 \times 6.01 \div 5 = 43.27$ divisions of 5° solution. Make up to 43¼ divisions with distilled water. The ¼ can be closely estimated with a little practice, or, if preferred, make up to 43 and add 4 septems of water. The solution is then thoroughly well mixed, checked as above, and bottled under the label—

"*Hydrochloric Acid*, 5°."

Using accurate apparatus and reasonable care, no difficulty will be found in preparing solutions that are accurate within 1 per cent The burettes used—there should be at least two—are mounted on a wooden stand, and should be graduated to 100 septems in 500 divisions. They should be fitted with glass stopcocks. Before charging a burette it is well to rinse it out with a little of the solution to be used. Then fill it up a little above the 100 mark, and reduce to the desired level. The tube below the stopcock must be quite full of liquid, all air being displaced from it. The litmus used should be so sensitive that a drop of acid or alkali is sufficient to determine the neutralization point. Little caps of card or tin will be found very useful for the bottles of test solutions, burettes, test mixers, etc., as a protection from dust, which is apt to settle around the stoppers and necks.

Tincture of litmus may be obtained ready made, but it can be prepared as follows: Take about half an ounce of litmus, coarsely powder, boil it in methylated spirit twice, rejecting the liquid. Then digest repeatedly with small portions of cold distilled water until all soluble coloring matter is extracted. Mix the washings, let them settle, and pour off the clear liquid. Add a few drops of pure sulphuric acid, sufficient to render the litmus solution decidedly red, thoroughly mix, and heat to boiling. Add baryta water, a few drops at a time, until the blue color is permanently restored. Let the liquid stand in a wide vessel freely exposed to the air, but protected from dust, until the white sediment has completely settled; then pour off the clear liquid into a bottle for use. A small glass tube, drawn to a point at one end, may be used for taking out a few drops of the tincture at a time. In any case, the tincture should be added to the solution drop by drop until a sufficiently decided tinge is obtained, and accurate results can only be secured by the use of the smallest possible quantity of tincture. Some analysts make a certain allowance on every titration for the acid or alkali required to act on the litmus; but with pure solutions such refinements are not necessary for practical purposes.

(To be continued.)

Presidential Address, Annual Meeting Southwestern Gas Association.

[Delivered by the President, Mr. William Enfield, Dallas, Tex., at the Annual Meeting of the Association, held in Dallas, Tex., March 12 and 13, 1890.]

Gentlemen of the Southwestern Gas Association: Another year has passed away, and we are again brought together in annual convention. I trust our third annual gathering will prove to be pleasurable, profitable and an all-round advantageous meeting. In coming together our motives are not to be construed as purely selfish; the good to be derived should be a benefit in common to each of us, and carried from hence to our individual companies, and indirectly to the communities whom we serve. The great old principle is also a good new principle, namely, in helping others judiciously, we invariably help ourselves. Let this be the extent of our selfishness, that if we can gain personally by helping others to gain, we will extend the hand of reciprocity to each other, to our confreres, and to our patrons in business.

It is true all the world over that a fellow-feeling and sympathy arise from kindred associations, whether of troubles and difficulties, pleasures and pastimes, profit and loss; and I have often been amused and pleased by witnessing the warmth of feeling displayed between two or more gas men when they come and relate their experiences. Who among you has not felt better for, encouraged and profited by, contact with a warm-hearted fellow gas man? It is not necessary to ask, does a gas engineer love his profession? I have rarely met one who did not show his high appreciation of his calling, and the frequent remark is that there is a fascination about the business which very rarely escapes the young disciple of Murdock, Clegg, etc. Here, then, are the grounds for the development of our Southwestern Gas Association. We want to be like the balance of the world; we want to thoroughly understand our business; and we believe that, combined with due personal effort, there is no better aid to the upbuilding of ourselves and our business than to meet in convention, to stand shoulder to shoulder for mutual help and encouragement.

Our boards of directors, too, we hope will appreciate the advantages to them of our coming together in convention. The short time and small outlay will prove a solid, paying investment, and as our Association grows and the attendance increases, the more profitable and interesting will the meetings be to each individual member and company.

The year 1889 has been fraught with many incidents of rather more than usually startling tendency to us of the Southwest. For many years we moved along at an easy, quiet gait, with few emotions, almost considering ourselves without the pale of the older States. Last year came a rather unusual growth and development in most sections, and with it the avaricious hand of idle capital, seeking whom it might devour. I will not repeat to you the ravages of the parent companies seeking points at which to unload their electrical machinery—you have been through it all and it is fresh in your memories, as is also the fact that some of the machinery was not unloaded, and we are fast recovering from the shock. This invasion has not been an unmixed curse, it carried with it its profitable side; probably both the invaders and ourselves have cut some more eye-teeth. We certainly have had the opportunity of gaining the necessary experience to start us on the road of electrical engineering—something which I hold, in common with many others, we should master with all due diligence and expedition.

When the parent electric companies cease their strife to unload their goods at points where not needed, and the consequent competitive and ruinous rates are removed; when we have fully learned, and I believe we will learn, that the public will have what they have the cash to pay for, whether we supply it or whether they have to look to some one else for it; when we fully learn that it is not always a question of cost, and that it is often a mere matter of choice, and the capacity to pay for it; when we have put in the best and most economical plant for production, and have worked up our business to the highest extent, and gotten every coal oil consumer possible to get, and gotten all those whom gas could not reach on account of prejudice or otherwise; when we have mastered this business, and shall manage it like any good business manager runs any like business, for the dollars and cents there are in it, then I believe we shall like this electric light and power branch, second only to our first good choice.

In late years many advances have been made in the manufacture of illuminating gases, most of them being in the line of obtaining complete combustion, and consequent efficiency. President Taber, of the New England Association, makes the very pertinent proposition that "What regenerator benches will do, compound condensing engines will do;" and, we might add, regenerator furnaces to our boilers also. I will here speak of the possibility of substituting the expansive force of rapid combustion of gases for that of steam. We are well aware of the high efficiency of the late improved gas engines, and when counting the cost of gas in the holders as the cost of the fuel used, we can very readily figure out the cost per arc lamp hour. The only question in my mind about adopting gas engines for this service has been the care of the engines, and their reliability to go off quickly and govern closely. With intelligent care and prompt attention I see no reason for special trouble. There is, of course, this difference between the steam engine and the gas engine, that the former, with indifferent adjustment, will work, in consequence of the force behind it, even if at a loss; while the latter moves conditionally upon its absolute adjustment. I am not qualified to speak of this matter from the standpoint of experience, but did lately fortify my good opinion of the system by corresponding with a very clever gas and electrical engineer who has had experience in this line, and who, having endorsed it, has removed some doubts from my mind.

One drawback to the introduction of gas engines is the first cost of same. The manufacturers have harped upon the gas companies to reduce and make special prices on gas, while they have made scarcely any concessions on *their* selling prices. Electric motors can be bought for very much less per horse power, and it looks a little like the old style of doing business—large profits and small sales; in the meantime our business suffers loss. But the invention of new engines, and multiplied factories for their introduction, will undoubtedly reduce the selling price unless the demand is abnormally large—for which latter we hope.

The gas business seems to have suffered but little from the quite extensive introduction of electric light, and this latter may be accounted for in many ways. I think it has been more the rival of kerosene than gas light; that it has been an educator in the use of more light for given spaces and uses; hence we have gained some where we have lost at points; most of our districts have made a good, substantial growth, and consequent increase of business of gas supply; most of us have introduced many gas engines, cooking and heating stoves, etc., and can show, on the whole, a good percentage of increase in our send-out.

Heat and power from the combustion of gas is a subject of absorbing interest to the gas engineers of to-day—especially to those of the territory which this Association represents. There are two things which have been in my mind as the two principal drawbacks to the introduction of day consumption for heat and power in our districts, namely, the ignorant, wasteful colored cook of the Southwest (who is monarch of all she surveys, or she is nothing at all), and the high selling price of gas for day consumption. As a remedy for the first, it is suggested to try educational methods; put the stoves out on trial, and try a second 30 days with minute instructions to both the lady of the house and the cook, being particular to point out to the lady the probable extravagance of the cook, and to offer her the suggestion that, in case her cook leaves her in hot summer weather, the cool, clean, convenient and easily managed gas stove will help to solve the problem of how to get along without help. Many means will be suggested by the manager's good judgment. The remedy for the latter can be easily figured out by yourselves, and it will be suggested to you that if your leakage account is 10 to 15 per cent. this can be cut out of all day consumption as clear profit, the leakage being the same whether you sell any gas for stoves and engines during daylight hours or not, most stoves, etc., requiring only the ordinary day pressure of 10 or 12-tenths in cities like ours; and in many cases the only additional cost of the extra gas used by stoves and engines will be little more than the material used, all other costs being mostly fixed charges, anyhow. Of course this figuring is subject to modification by circumstances, and each one's individual surroundings qualify him only to be the judge and compiler of facts existent.

I was somewhat surprised at the offer of some 14 cook stoves below cost, that had been commissioned to a gas company in a Texas city of some 50,000 inhabitants, with the explanation that they had put out only one, and had to take that one back. I know of a board of directors and their superintendent, not 400 miles from here, who are far from being satisfied with a record of the following, which was handed me:

Ranges	38
Boiling stoves	32
Tailors' and laundry heaters	32
Coffee urns	7
Heating stoves	17
Instantaneous water heaters	21
Gas engines	10
Gas pumps	7
Total	164

and a daylight consumption of about 8,000,000 per year. If this superintendent were not one of you, I might say that for a city of 40,000 to 50,000 it is not—but I cannot be personal. I cannot say what Dallas has done in this line, except that she is not quite worthy of promotion to the schedule of Eastern records yet. The fact that a dozen or so of gas cook stoves go begging around our Southwest can be perhaps a very sufficient excuse for my extended remarks on this subject.

There has been much discussion as to the advisability of selling fittings, fixtures, piping and stoves at cost. I think from the reading of the matter that the majority unquestionably favor the scheme. In most commercial businesses drayage and cases are furnished at cost, if charged for at all; and our case seems to be analagous. Our business is to furnish gas, it is true; but the supplies through which gas becomes of utility to the consumer are necessities in the case, and if controlled entirely by outside parties we then hold in a measure a secondary position to meet fully the wants of our patrons, to assist them in becoming our customers, and last, but not least, to be able to push our business to the full extent of its possibilities. We are no longer monopolists. Having competitors and strong competition, we cannot lie back at our ease and say they must take our gas or go without light, heat or power. The electric arcs, incandescent lamps and electric motors stand before us as rivals, with 1890 energy behind them to push them; and they do not always take second place. I have a letter from a fellow gas manager before me upon this subject. He is introducing stoves, and remarks: "By Jove; but it's up-hill work!" He also says he had heard that I was not satisfied with selling stoves, fixtures and piping at cost. Brother gas man, all work, especially introductory work, is on the up grade; and more especially if your selling price for gas is too high. On the second count I am glad of such an opportunity to refute such an understanding. I shall sell these articles at cost as long as my Board of Directors allow me to do so. My motto is, "Carriage at cost, and a fair paying price for merchandise delivered." My correspondent also asks, "What course do you pursue when a party asks you for a meter, he being a customer of the opposition electric light company, and merely wanting gas for a convenience when electric light goes out?" This is hard to answer for all cases. I try to bear in mind that we cannot afford to make enemies, and if meters are plenty it is perhaps best to put them in and charge rent.

Water gas seems to be farther from our reach to-day than perhaps a year or two ago; anyway, upon investigation we find it difficult to see any money in it with anthracite coal at $10 to $11, and Eastern coke at $9 per 2,000 pounds, and Lima crude at 5 to 6 cents per gallon, and no residuals to reduce the cost. But the system might be introduced into the largest works, perhaps, as an auxiliary, by using the coke product of the works when the market for the same is insufficient.

Cannel is used in many of our works, is easily handled, and found to fill the bill for enriching.

With our native coals we cannot expect to get the 10,000 per mouthpiece, even with half or full regenerator furnaces; nor to save 70 to 80 per cent. of our coke. I have tried both second pool Youghiogheny and our own Indian Territory coals in the same benches, with half-depth regenerators, and find no fault with the furnaces or manner of working them; but that, at the relative cost of the coals, the second pool compares very favorably in results, the furnaces saving from 70 to 80 per cent. of the second pool coke, and making a yield of 9,000 to 10,000 per mouthpiece, retorts $14\frac{1}{2} \times 23 \times 9$ feet.

There are now several works in our territory of a size to warrant the introduction of the Coze system of inclined retorts, with hydraulic elevators and tram dump cars, stage floor firing, full depth regenerator furnaces, concentrating liquor works, and the general modern improvements contained in the larger Eastern works; and the suggestion comes to us to prepare ourselves for such improvements in case of rebuilding, and to keep pace in general with all the advancement of the times. In this, our warm climate, any labor-saving and hard manual labor-reducing appliances would be doubly welcome to ourselves and our employees.

In connection with the fuel gas problem, I am persuaded to quote the question before the Ohio Gas Light Association: "Is not illuminating gas of a good candle power, sold at a reduced price for fuel, the true solution of the fuel gas problem?" Watering milk does not increase its intrinsic value, and condensed milk costs less for transportation. Could not most of us deliver 100 per cent. more than we do now, with the same

facilities, if delivered during the hours when our mains and services are in a measure idle?

And now, gentlemen, the wide field of discussion and study is before you; enter into it freely. It is yours both by adoption and right. Problems, improvements and inventions lie before you in profusion. The day for the idle gas manager is gone by; each year adds more to the duties and labors of the gas engineer, and we must both run and read. I trust you will discuss freely the subjects and papers before this convention. Let us enter into the work and detail necessary for the upbuilding of this Association with all our hearts; having done so, its success is sure, and the benefits will be manifold.

Freezing Machines Shown at the Paris Exhibiton.

M. Gustave Richard (through his publishers, M. Bernard & Co., of Paris, France) has prepared a most interesting volume, treating of the apparatus mentioned in the heading. A contemporary, in reviewing the author's work, says that this very complete study of modern cold-producing machines, is, the author states, only an extension of the report presented by him to the International Congress of Applied Mechanics. It is not intended as a treatise on the subject and so contains but a short account of the theory of such machines, and the rest of the volume, fully nine-tenths of the whole, is devoted to descriptions of the numerous mechanical arrangements in which the theory has at various times been embodied. M. Richard divides the modern machines into two main classes, viz., machines in which a gas is simply compressed to a smaller volume, and machines in which the gas is liquefied. This latter class he subdivides into machines which depend for their action on chemical affinity, such as the ammonia absorption machines, and machines which are worked by mechanical compression of the gas by pumps. Cold-air machines, which seem to have been invented by Siemens in 1857, are practically the sole representatives of the first class. Such machines consist in general of a compressor, an air drier and cooler, an expansion cylinder, and the refrigerator. In the compressor the air is drawn in from the atmosphere, compressed to but a small part of its original volume, and forced into the cooler, where its temperature is again reduced to nearly its original value. From the cooler the air passes to the expansion cylinder, where it expands whilst doing work and is therefore greatly cooled down. On exhausting from the expansion cylinder the air is ready to pass to the refrigerator. In closed cycle machines the air on leaving the refrigerator passes back to the compressor, but in open cycle machines is allowed to escape into the atmosphere.

Though the theory of such machines is simple enough, considerable difficulties are encountered in attempting to embody it in practice, and the object of M. Richard's work has been to show how these difficulties have been met and overcome by the numerous inventors who have turned their attention to the subject. Most of the difficulties arise from the presence of water in the air, which freezes as the temperature is lowered, and unless suitable precautions are taken chokes the valves and valve passages.

In closed cycle machines the difficulty can be avoided by drying the air once for all as it enters the machine, and by taking care to replace any air lost by leakage also with dried air. In the Windhausen machine —an early one of this type—the drying was effected by passing the air through chloride of calcium. In open cycle machines, where large quantities of fresh air are continually passing into the machine, this method of drying the air by chemical action cannot very well be adopted, hence in later machines of the open cycle type Mr. Windhausen has deprived the air entering the expansion cylinder of its moisture, by passing it through a seperator and cooler, the temperature of which is kept down owing to its being surrounded by the air exhausting from the refrigerator. On having its temperature lowered in this way, the air parts with most of its moisture before entering the expansion cylinder, and the trouble of ice in the pipes and valves of this cylinder is got over. In the machines of Messrs. Hall and Lightfoot, another method of drying the air is adopted. For this purpose the expansion of the air is allowed to take place in two stages. During the first stage its temperature is considerably reduced, and as it passes to the second or main expansion cylinder it is freed from its moisture by means of an anti-primer, and when it finally escapes contains extremely little moisture, as most of that left after the first expansion is deposited in the snow boxes of the main expansion cylinder.

An important point in all these machines is to reduce the clearance space as much as possible, and many makers have paid great attention o this point, but Giffard seems to have been amongst the first to appreciate its importance. Much of the loss, can, however, be avoided by adopting the compound system and compressing the air in stages, though from M. Richard's description it does not appear that this plan has been adopted by any of the builders of cold-air machinery. On the other hand the compressors for the Whitehead torpedoes constructed by Mr. Brotherhood are arranged on this principle, the total compression being done in three stages.

Passing next to the case of machines in which the gas used is liquefied by compression, M. Richard thinks that these machines may be considered as "inverted" steam engines, just as the cold-air machines may be considered as "inverted" hot-air motors. Just as the hot-air motor for a given power is much less compact than the steam engine, so is a cold-air refrigerator much more bulky for a given output than one working with a gas which liquefies under pressure. This is largely due to the fact that the expansion cylinder can be entirely suppressed. The gases usually employed are, M. Richard states, sulphuric ether, methylic ether, methyl chloride, sulphurous acid, and anhydrous ammonia. Ethylene and carbonic acid gas have also been employed for this purpose. M. Richard gives a diagram showing the relation between the temperature and pressure of the above gases, but the diagram is somewhat sketchy, which is a pity, as complete and accurate curves showing these relations would be very valuable. It is, however, not unlikely that sufficiently complete and accurate data to allow of this being done, do not yet exist.

Ammonia is the most frequently used of all the above mentioned gases. Its principal advantages are the comparatively low pressures at which it liquefies, viz., 8.4 atmospheres at 20° Cent., and its large latent heat of liquefaction, viz., 900 heat units according to some authorities, and 560 according to others. Hence ammonia machines of large refrigerating power may have very moderate dimensions. In this latter quality of compactness they are however surpassed by the carbonic acid machines, which, according to Mr. Windhausen, are only one-fifteenth the size of ammonia machines of equal refrigerating power. On the other hand, however, the vapor tensions of this gas are very high at ordinary temperatures, as much as one-half ton to the square inch, and hence the various joints of machines using this gas are severely tried. One of the most curious points about ammonia machines is the fact that neither brass nor gun-metal can be used in their construction, as both are attacked by the gas.

In all these machines using other working agents than air, it is most essential that the leakage from the machines shall be reduced to the smallest possible amount, and M. Richard gives very complete descriptions of the methods which various inventors have adopted to this end. One of the most interesting of these is the frozen gland packing, which Mr. Fixary has adopted for his pump rods. The upper part of his stuffing box is filled with oil, which is frozen by leading round this portion of the box, ammonia gas from the refrigerator, which congeals the oil, and makes, the inventor claims, a perfectly tight and frictionless joint.

To avoid the loss from clearance many makers have adopted the plan of filling the clearance spaces with oil. This completely gets over the difficulty, but a separator has to be provided to free the ammonia from the oil carried with it through the pump valves, and it is a question whether the adoption of the compound system is not a better way of avoiding the difficulty.

Passing on from the above machines, many of the best examples of which are illustrated and very fully described, M. Richard proceeds to the case of machines working on Carre's principle, in which ammonia dissolved in water is expelled by heat, and liquefies under its own pressure in an "evaporator," the required degree of cold being subsequently produced by the evaporation of the liquefied ammonia, and the large absorption of latent heat then occurring. Amongst the machines described in this section are those of Messrs. Pontifex and Wood, who have worked the question out in a very thorough way, and succeeded in converting the original intermittent machine of Carre into a continuous working one.

Another machine described in this section is Mr. Perkins' ingenious Arctos icemaking machine, which has the great advantage of a complete absence of valves, and of the accompanying glands and stuffing-boxes, which in machines of the usual type require so much care to keep them tight. With this machine M. Richard concludes his account of mechanical refrigerators, and the rest of his work deals with the different ends to which these machines have been applied in practice. The different types of cold rooms for the storage of perishable viands are fully described and illustrated.

THE dividend (3 per cent.) for the last half of 1890, recently declared by the Directors of the Portsmouth (N. H.) Gas Light Company, is payable to-day.

[A paper read before the Southwestern Gas Association, March 12, 1890.]

Gas as a Source of Light, Heat and Power.

By Mr. William Enfield, Supt. Dallas (Texas) Gas Light Company.

These words have a magic and magnetic influence. Light we have, heat we boast of, and our power is unrivaled in cost and general utility. Shall we not push, with an energy born of a time fast approaching the twentieth century, this commodity of ours in which we have so much faith? Illuminating gas has not seen its day, as our rivals would fain have believed, and fuel gas, just entering a field that is as broad as the earth, only awaits the energy of its advocates to make it as expansive as the field itself. Mammoth ideas and theories will eventuate in mammoth plants for the production of our tripartite industry, and the modern gas engineer's pet scheme of cheap fuel gas will, perhaps in the next decade, but sooner or later anyway, become an assured and commercial fact.

I have neither time nor the ability to fully demonstrate the reasons for the belief which is in me, and can only hope that very soon the introspective disclosures of some master mind's intitution will lay bare to us the plan and procedure for the accomplishment of our desire to expand our theories into successful practice.

I think the day is not only dawning, but that we are well on the way to fuel gas distribution. Yet it sometimes surprises me to see the timidity with which this subject is approached, and the overcautiousnes with which capital views the embarkment into plans and practices which would undoubtedly make liberal returns.

Are we not choking the goose which would lay the golden egg? Do we not cover up our possibilities with much mystery and over-carefulness? If the same amounts of energy and daring were put into the gas business, that have been put into the electric business for the past ten years, our gas works would be more pressed for capacity to supply the demands than they now are, and everything in favor of gas over electricity. Still we can dwell with satisfaction on the progress already made, and I must add that my remarks apply more particularly to our Southwest than to the other States. I recently read one gentleman's assertion that he would put gas at 60 cents per 1,000, if for an extensive use as fuel. Whether he can do this with 17-candle power gas or not, he knows best, and how. Doing so, and if successful, he has no doubt, solved the fuel gas question by the use of one set of works, one set of mains, and a gas no doubt the equal of diluted fuel gas at 30 cents per 1,000. There are also these advantages: The more he makes, the cheaper he makes it; leakage is also constant for any given size of works, whether output is large or small, and many items of cost are fixed charges, whether output be much or little; consequently, it is a cheapening process all the way through.

I have noted with interest the difference in the number of stoves and engines in use in various cities, and in many instances, the causes of the discrepancy can probably be traced. We cannot expect disinterested parties to assist in the upbuilding of our business—in an emphatic sense we must help ourselves. A stove dealer who has gasoline, wood and coal stoves for sale is not at all likely to push the sale of gas stoves as we ourselves ought to do; neither is a gas fitter and fixture dealer to be expected to do work and sell at cost—points which we can well afford to concede in order to gain a permanent customer. I have sometimes found it necessary to figure vey closely against electric light men, in order to decide a consumer against wiring: while this should be done without actual loss, the advantage of having your men fully employed all the time is on the profit side.

My remarks are but hints at possibilities. It remains for individual companies and their representatives, whom you are, to work out their own salvation. I use this word salvation advisedly, for the reason that what it is possible to do, if not done by ourselves, may prove an open door for rivals to enter. In fine, we have but to follow out business principles, one of which is to make all the friends we can by cultivated, courteous treatment to all.

In furnishing light, which has been our prime object, every detail should be attended to in order to give continuous good service. Small items of cost, such as burners, tips, the care of Lungren lamps, meters, services, drips, and uniform good pressure and service, bring back to us ample returns. Candle power, too, is a matter of consequence, and will be unfavorably commented upon if not uniformly good. In furnishing gas for stoves, the same diligence must be preserved, methods of economy taught, and, in fact, it is here we must become educators, as the field is yet comparatively new. By demonstrating how bills can be kept down, and the use of gas for these purposes made to compare favorably with solid fuels, besides the convenience and cleanliness of the system, we may introduce one and another, and each stove, in a lady's hands, will become an advertisement for others. This is the way it has been accomplished in general, though the detailed plans have been various, and such as were suggested to the individual authors thereof—cooking schools, stoves on trial, rented stoves, public dinners, canvassers, novel advertisements, and any good business scheme can be tried with varying success.

Gas for power is a field of its own, and promises unbounded development. My time is too short to present many suggestions—figures I have not prepared—but with cheaper motors of this kind and cheaper gas for their motive power, who will question the extent of development in this department? I am persuaded that even we ourselves do not appreciate its possibilities. I am in receipt to-day of a circular showing cut of gas producer and gas engine in connection therewith. The large gas plants, I think, should be, by their favorable conditions as large plants, the source of supply for all demands within their reach. In this connection, and in conclusion, I would like to introduce some inquiries made of an electrical and gas engineer as to the use of gas engines for running dynamos.

We are now running two 150-horse power Russell, high speed, balanced valve, automatic engines, and our fuel consumption is 10 lbs. coke per arc lamp hour. Coke from Indian Territory coal, 20 per cent. inferior to Pittsburgh coke. Our cost for fuel is almost one-half of running expenses, with native coal at $4.75 per ton on cars. This is excessively high, and it appears to me to be much to our advantage if we were to introduce gas engines for power. Do you experience any trouble in maintaining uniform power and promptness in starting your engines? Are the lights steady and uniform? How often do you change and clean valves, and do governors act with precision? What is the relative cost of gas as against coal? Do you think the power, outside of its economy, as reliable as that of steam? Any information your judgment may think of value to us, we will highly appreciate.

[In connection with the concluding sentences of Mr. Enfield's paper we have to say that no stenographic report of the replies to the queries was made. While this omission is regrettable, it nevertheless serves to bring out prominently the value of reported discussions; for despite the fact that the paper was read almost a twelvemonth ago it would be as pregnant with important lessons now as those that taught then in the replies that were made. If any of our readers see fit to use the columns of the Journal to reply to the questions propounded by Mr. Enfield, we shall take great pleasure in affording them all the space required.—Eds.]

Fire Resisting Construction.

On January 23d Mr. C. J. H. Woodbury, of Boston, Mass., delivered a very interesting and well-prepared lecture, on "Conflagrations in cities, before the Franklin Institute, Philadelphia. From the abstract prepared for *Engineering Record*, we find the lecturer reported as having said that while the origin of most fires is due to causes which are in the control of owners or occupants, the destructive extent of nearly half the fires is due to faulty methods of construction, which might have been prevented in greater or less degree by the adoption of methods not involving excessive expense or unusual appearances in construction. These methods of safer construction are matters of common knowledge among competent architects, but they should not be held at a fault for mistakes due to the avarice or prejudice of owners.

Methods of building construction, with a view to the application of methods of the greatest safety, Mr. Woodbury continued, need not interfere with the free exercise of the highest degree of taste. An ugly building is not necessarily a substantial one, any more than a homely person is necessarily good—although the greater portion of humanity willingly find comfort in the proverb concerning the Flemish beauty and the accompanying intrinsic merit.

The work of the underwriter is largely dependent on that of the architect, because every variety of building material and every method of construction, irrespective of the use to which the building is put, is more or less destructible by fire; therefore the work of the architect must be judged in a certain measure by the methods of the underwriter.

There are certain types of construction of commercial and manufacturing buildings in cities, which experience has shown to be peculiarly adapted to resist destruction by fire, and a general consideration will be given to some of these methods.

If a building could be so constructed that its contents could burn and destroy the interior, without endangering the neighooring buildings, it would never cause a conflagration. A fire-proof building, however, is a commercial impossibility, because if one could be constructed so as to withstand the destruction of its contents, it would be good for little else, and the cost would be prohibitive.

When William A. Green was chief of the Boston Fire Department, he received a letter from an official at Berlin asking for a description of the fire-proof public buildings at Boston. He replied that they had but one, the Beacon Hill Reservoir, and sometimes they did not feel quite sure of that.

Improvements on the score of safety to buildings in cities are feasible only so far as they do not offend the present methods of taste in design, or interfere with the purposes for which such buildings are to be used; and all modifications must be made without undue cost, and under such conditions that any additional expense will prove a good investment in the diminution of the fire hazard, as measured by a reduction in the rates of insurance.

Any other method of treating the question in the attempt to direct the construction of buildings, regardless of all considerations except the reduction of the fire hazard, would be comparable to the answer of Brunel, the civil engineer, when he told the Parliamentary Commission that he believed the purpose of the Creator in making rivers was to feed canals.

The methods of safe and solid construction are, however, less expensive than the hollowness of alleged decorations, whose only definite characteristic consists in their perfect fitness as fire traps.

These questions of safe construction naturally resolve into two classes —the one including measures to prevent fires communicating from one building to another, and the other including measures to obstruct a fire from extending throughout the various stories of a building.

Both of these conditions may be idealities as to their complete fulfilment, but it has been found feasible to reach favorable results in these directions.

Any building ordinances which pertain solely to the entire construction of new buildings will be very slow in their application; but in most instances, changes can be readily introduced which would materially diminish both classes of hazard. Any measures which could do away with the conflagration hazard in cities would reduce the fire loss very materially.

The first consideration should be given to the means of reducing the conflagration hazard. This is accomplished simply by the maintenance of the walls, the protection of all necessary openings, the abolition of wood cornices, and the protection of the roof, all of which precautions have been taken in most of the first-class buildings in cities.

Brick division walls, heavy enough to withstand the excessive stresses incident to a fire, will be uninjured by flames which cripple iron and decrepitate stone. It is preferable that all walls should extend above the roofs; but where that cannot be done the cornices should be of terra-cotta, stone or metal.

All openings in side or rear walls which would become a source of danger in case the adjacent buildings were on fire, should be provided with fireproof doors or shutters, which should always be closed at night.

These doors or shutters should be made of two thicknesses of matched boards, of thoroughly seasoned stock, laid at right angles to each other and covered with sheets of tinned iron laid with locked joints similar to the method generally used in tin roofing. The hangings, whether trucks or hinges, should be secured directly to the wall, and fastened to the door or shutter by carriage bolts, not screws.

The butts for outside shutters should be made of galvanized iron, or some other material which would not allow the hinge to stick by rust. In division walls of large buildings these doors should be double, one door at each side of the wall.

Doors made after such a method have resisted the most severe exposure in burning buildings; while it is known that either wrought or cast iron doors cannot withstand the heat of any considerable fire.

The occupant of a large building in Boston asked advice upon the best methods to render the building safer, and among other matters, it was suggested that tinned fire doors should be placed at the openings in the division walls in place of the iron doors.

He replied that he would most gladly make the change, were it not that the conditions of the lease make it necessary that iron doors should be kept at these openings. But on being asked if any clause of the lease forbade the addition of tinned fire doors in front of the iron doors, he replied in the negative, and afterwards had some excellent fire doors made. They were, however, hung on hinges secured to the *furring* and *not* to the brick wall.

In a short time a fire started in the building, and, passing up the hollow spaces between the studding and the wall, caused the whole finish to separate from the wall, carrying the fire-door to the cellar, where it lay among some burning anthracite coal for a week, and was then removed to a certain insurance office, where it served as an excellent example for many years.

The iron fire-proof door did not long remain in position after the tinned door was pulled away from in front of it, but yielded and allowed the fire to proceed through the opening into the adjoining building.

The floor supports should be attached to the walls in such a way that the walls shall not be injured by falling beams and girders. The preferable means for accomplishing this result is first to place the beams so they will not penetrate too near to the outer face of the wall. They should then be secured to the walls by a wall plate with a tongue entering a transverse groove across the under side of the beam, or by the cast iron anchorage box invented by Henry A. Goetz. Wood beams anchored to the walls by either of these two methods will not endanger the walls in the event of a beam falling from any cause.

In the case of iron girders the problem is different, as the changes in the length of such girders with ordinary variations in temperature would not permit a rigid anchorage. This expansion has been sufficient in case of fire to produce serious results.

In his report on the great fire of Nov. 28, 1889, the Boston Fire Marshal states, in regard to the Ames Building, which was among those destroyed, that the walls of the building were thrown out by the expansion of the iron roof. Allegations have also been made concerning destructive results caused by the expansion of iron girders at other fires.

The question of roofs is a very important one, both in regard to their yielding from a fire inside, and also their ignition from outside exposure. The statement made by Benjamin Franklin, that, "next to a good foundation, a good roof is the most important part of a house," is even more applicable to day, as the crowded condition of cities has given other functions to roofs than merely those of shelter.

The most substantial roofs for commercial buildings are those constructed of plank, and nearly flat, having a slope of half an inch to the foot either toward the center or the edges. When the various courses of roof covering comprise a solid thickness of three inches of wood without any intervening air space, then the building is covered with a roof which will protect the upper story against extremes of temperature—resisting both the heat of summer and the cold of winter. A fire of the contents would not burn through such a roof so long as the supports were intact; and if the outside was protected by any roof coverings suitable for flat roofs, it would be difficult for a neighboring fire to inflict any injury on such a roof. It is important that such a roof should have an opening covered with a door as thick as the roof, and that it should be provided with a permanent ladder or stairway leading to it.

The questions relative to the protection of buildings against fires originating in them involve matters of detail pertaining to methods of interior construction and occupation which in themselves would exceed the limits of the allotted time; but at the risk of making some digressions not strictly bearing upon conflagrations, except in that relation which one fire always bears to another, the importance of the subject is offered as an excuse for referring to some of the salient features of interior defence against fire.

President F. C. Moore, of the Continental Insurance Company, states in his monograph on "Economical Fire Resisting Construction" (p. 4), that of the fires which exceed $100 in damage, only one-fifth are extinguished short of total destruction of the building and its contents.

In connection with this, it may be interesting to note the percentage of fires which *caused* a partial loss amounting to over $100 as compared with those which resulted in the general destruction of the building and contents, as shown in the reports of fires on property insured by the Boston Manufacturers' Mutual Fire Insurance Company, from which it is learned that in the last 13 years there have been 457 fires, causing a damage of $100 or over, and only 61 of these fires may be classed as total losses, having caused the general destruction of the building and contents.

The greater proportion of the fires noted as total losses were in mill tenements, storehouses, and dyehouses—classes of property whose conditions do not permit the application of methods of protection in general use in mills.

These facts in regard to fires occurring upon manufacturing property of normally great hazard, serve to show what results have been obtained by suitable precautions in the way of construction, fire apparatus, and care.

It is not easy to introduce changes in the hazard of dwellings, as their owners and occupants are not inclined to vary from customary methods, but the owners of mercantile and manufacturing property are far more ready to give consideration to suggestions designed to reduce the fire risk.

A building made of incombustible material is not necessarily fire resisting, as a combustion of the contents of almost all commercial buildings, except office buildings, will weaken unprotected iron beams and

columns, and reduce the strongest stone to powder. This destruction of rock is caused by the conversion into steam of the water absorbed by the stone.

Nearly every city is provided with building regulations, which are generally teeming with errors of omission, and often contain provisions for methods of construction which are as far behind the times as the old buildings which are torn down to make way for the new structures to be erected in accordance with the provisions of the new regulations.

The increasing height of buildings, whose profitable use has been made possible by the passenger elevator—which was very properly designated by its inventor, Otis Tufts, in his patent as the vertical railway—presents a problem which is not fully met by the use of incombustible material in construction.

This increase in the height of buildings was clearly indicated a short time ago by one of the magazines, which contained two views of the southern part of New York city—the one being from a daguerreotype of many years ago, and the other from a recent photograph taken from the same place in Brooklyn. Trinity steeple and a few landmarks served as scales by which to estimate the increasing height of buildings, which appeared to average certainly more than double—with exceptional examples lofty enough to suggest the sin of Babel.

Want of care in the construction of flues or chimneys is the cause of an enormous number of fires, especially from cracks, caused, in many instances, by girders or beams too near chimneys. Soot deposited in such cracks becomes ignited in the course of time, and acts as a fuse to ignite some of the woodwork at the floors, or the interior finish of the building.

Hollow, concealed spaces in floors and walls are a source of great destruction by fire. It is certainly preferable, as regards matters of safety, to design buildings without such dangerous spaces; but the traditions of construction seem to be so entirely opposed to such methods that they must be recognized, and faulty practice modified, as far as possible, by the introduction of fire stops in all vertical concealed spaces at each story, and any continuous spaces, particularly in the attic, should be cut off at as frequent intervals as can be arranged.

The ceilings over furnaces, boilers, and hotel cooking apparatus, if near enough to become, in any manner, a source of danger, require special provisions to insure safety. All hollow spaces should be removed, and woodwork is generally best protected by means of lime plaster laid on wire lathing, conforming to the surface of the under side of the floor.

The supports of a building should be arranged to resist injury as a result of the combustion of the contents, or of the lighter portion of the interior. Timber beams and columns fulfill this purpose as well as any material ; but it is frequently necessary to use iron or steel to obtain the necessary strength, in which case the metal should be protected with heat-resisting material, generally with special tiles made for the purpose.

The best type of a commercial building is that where the floors are continuous ; the openings for elevators, stairs, and transmission of power being an inclosed in tower. This isolation of the various rooms from each other would render such a building well nigh indestructible by fire, but such a separation would not generally be considered adapted to commercial buildings, with the exception of storehouses. During the last year Mr. Woodbury designed a 6 story building of this description, which is situated in the compact portion of a city, and occupied by numerous tenants engaged in various kinds of manufacturing.

This method of interior construction, instead of being an added expense, cost about $3,500 less than the estimates for a similar structure with joisted floors of equal strength and rooms of the same height in the clear.

The rate of insurance is said to be the lowest ever given to a building under these conditions of occupancy, height, and exposure to conflagration hazard.

Similar methods can be applied to other commercial buildings, but it is doubtful whether this method of arranging a stairway might not interfere with the requirements necessary in many commercial buildings, particularly those devoted to retail business, and buildings where elaborate decoration in interior finish is desired; although in buildings where such displays are necessary, the construction could be rendered more fire resisting by the adoption of methods involving a higher expense than the ordinary methods.

The advantage of sound construction has never been more strongly illustrated than in Paris during the commune of 1871, when the mob sought to burn the city by the free use of kerosene, and only succeeded in burning the individual buildings which were set on fire, notwithstanding that there was no fire department to combat the fires. Photographs of streets taken after these fires show that the front walls of the burned buildings were still intact.

The floors of this building are of the usual slow burning construction type, the timbers consisting of southern pine beams of 18 feet span, bolted in pairs, making solid beams 12 by 14 inches, and laid 8 feet on centers.

The floors upon these beams consist of 3-inch spruce plank planed underneath and with splined edges. These planks are 16 feet in length, and therefore each one rests on three beams. In order to render the load on the beams uniform, the courses are broken every 2 feet. Two thicknesses of abestos paper are laid on the plank before the top flooring of birch is laid.

The roof is similar in construction, but only 3 inches thick. It is lowest in the middle, and the brick walls form a parapet around the sides. All windows, except those at the front, are provided with tin shutters.

The peculiar feature of the building, however, is the means used to isolate the various stories from each other by making the floors entirely continuous and without any openings whatsoever.

A tower in the middle of the building, placed 24 feet from the entrance, and measuring 10 by 17 feet, made of brick in the lower portion and 3-inch plank above, extends through the roof, and is covered by a large skylight, protected as all skylights should be, by a wire netting underneath.

This tower contains stairways and elevator ; and at the rear of it is another division for the wash rooms, and to carry steam and water pipes. Adjoining this is the belt tower, the power being transmitted to each room along a line of shalfting. The whole arrangement occupies an area of 10 by 31 feet in the middle of the building, where the light is the poorest, being, therefore, the space least valuable.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, JAN. 10, 1891.

The Weather.—Professor Lewes on Gaseous Illuminants.—The Chemistry (?) of the British Medical Journal.—Labor Strikes.—The Sulphate Market.

I must commence this year with the Englishman's favorite topic—the weather. Some of our older friends are in the habit of talking about the winters they used to have in their younger days, as compared with the mild seasons that have now been the experience in this country for several years. Indeed, we had almost ceased to expect any severe weather before the end of the year. But this winter we have had a rude awakening in the shape of continual frost, snow, fog, and the absence of sunshine and the usual extent of daylight ever since the beginning of December. I need not point out that such weather means a great increase in the demand for gas, and the general experience has been an increase of 15 to 25 per cent. over previous records for the month. But gas engineers have been affected in this respect, that on account of the facts above mentioned they had almost come to believe that no severely cold weather need be expected until after the end of the year, when the additional demand for gas would be partly compensated for by the lengthening of the days. The result of the cold weather coming earlier, at the time of the shortest days and Christmas festivities, has been to try their resources to the utmost. The usual rule is a reserve retort capacity of about 20 per cent., and this has been fully drawn upon. In some few cases it has proved unequal to maintaining a proper supply, and of course, where the policy of sailing as closely to the wind as possible in the mater of expense has been followed, trouble and dissatisfaction have resulted. For those who are well prepared it has been a good harvest time; but for others, the extra expenses consequent upon working at high pressure will go a long way toward swallowing up any increase of profits resulting from the enhanced demand. Constructors of gas works plant are looking upon this state of things with complacency, for at many gas works where it was supposed that sufficient provision had been made against increase of business for some years to come, the experience of the past few weeks will insure substantial additions being put in before next winter. And especially will it have the effect of directing attention to water gas plant as a means of meeting unexpected and sudden increase in demand. The paper recently read by Mr. A. B. Slater, on water gas as an auxiliary at coal gas works, will be attentively read and studied.

A special feature of the present season is the delivery of a series of five lectures on "Gaseous Illuminants," before the London Society of Arts, by Prof. Vivian B. Lewes. Not the least interesting point about them is the evidence of the broader views that are now beginning to pre-

vail (and none too soon) in English gas circles. It is some years since any lectures touching directly on the general question of the chemistry of illuminating gas, its composition, products of combustion, etc., have been delivered, and on previous occasions attention has been confined to coal gas, with a casual glance at water or oil gas as subjects of passing interest but of no practical utility. Prof. Lewes, however, treats coal gas not as *the* illuminating gas, but as one amongst oil gas, carbureted water gas, and other processes. He also has something to say about the possibility of maintaining the quality of gas at any desired degree by the aid of carburation—a matter that cannot fail to be interesting to London Gas Companies, who are smarting under the rigorous scrutiny of the newly appointed County Council, a body anxious to ingratiate itself with the public by inflicting full fines without rhyme or reason, for the slightest dereliction in the matter of illuminating power. So that although gas engineers will find much with which they are already acquainted in the lectures, they will also meet with a great deal of decidedly original matter, to say nothing of several points that have been investigated by Prof. Lewes for the first time. The lectures are not of so much importance to makers of gas who usually have to turn the cheapest available material to account, and therefore are not able to select their manners and modes of working, as to users, and especially to makers of gas burners and apparatus. And they especially illustrate the importance of a proper regard to ventilation in connection with the use of gas stoves. This is the more necessary because the English public have an inborn prejudice against ventilation. They would never ventilate their houses at all if they could possibly help it, and any of the so-called "self-ventilating" appliances, "no flue necessary," etc., are regarded with favor and eagerly adopted.

A notable slip of the pen has been performed by the *British Medical Journal*, in writing about the products of combustion from coal gas, and so the paragraph containing the erroneous statement has been copied by several papers, and adopted without question by the author of a paper on "Conditions of Safety in the Use of Geysers," reproduced in your own columns—see p. 913, near bottom of first column. It is advisable to direct attention to it, because such an assertion unduly prejudices gas. I refer to the statement that "30 feet of gas produces on combustion 60 feet of carbonic acid." Now, 1 volume of carbon vapor combines with 2 of oxygen to form 2 volumes of carbonic acid, so if this was correct it would follow that 1 volume of coal gas contains an equal bulk of carbon vapor, which requires for complete combustion 2 volumes of oxygen. After allowing for the oxygen necessary to burn the hydrogen, it would appear that gas requires something like 3 times its bulk of oxygen, or 14 to 15 cubic feet of air for each cubic foot of gas burned, for complete combustion. As a matter of fact, it has been shown over and over again that gas only requires a little more than its own volume of air, say 6 feet of air for 5 feet of gas, and that it produces, not double, but *one-half* its bulk of carbonic acid. Probably this is what the writer in the *British Medical Journal* meant to say, but happened to get a little mixed up. It is to be hoped that he is more accurate in the matter of writing prescriptions, else his patients are likely to suffer. While on this point I may remark that, light for light, if we take the carbonic acid produced by gas as = 1, that given off by oil lamps is about 2, or by sperm candles 2½. Yet for some reason or other gas is decidedly unpopular with gentlemen of the medical profession, many of whom recommend candles or oil as the more wholesome.

The unsettled state of the atmosphere amongst the wage earning classes, which found evidence last year in the strikes at the South Metropolitan gas works, at Manchester, and elsewhere, has evidently not calmed down. So far as the gas industry is concerned, the stokers and laborers have found out that after all their employers are their best friends, and that the idea of "fighting," which was so seductively placed before them by persons of the class known as "agitators," was simply a form of quarreling with their bread and butter. Gas workers as a body are well and fairly treated, and any forced payment of higher rates of wages could only lead to one or both of two things, each of which would have a great effect in diminishing the demand for unskilled labor. These are the introduction of labor saving machinery or an increased charge for gas. The latter would certainly afford increased scope for the introduction of electricity and oil, with a corresponding decrease in the use of gas. For the most part the men have sense enough to see these facts, and so the present season has not been attended by any labor dispute of important dimensions in gas circles, though here and there we hear of a strike in some small town, or of a dispute between "union" and "free" men, showing that there still remain a few smoldering embers from the conflagration that raged so furiously a year ago.

This year the railway workers in Scotland are taking their turn, and matters have gone so far that traffic is greatly impeded and almost entirely stopped. It is a peculiar feature about "strikes" that they always result in injury to persons entirely outside the matter in dispute. Several instances might be quoted of merchants who lost the chance of selling goods, or suffered from delay in the delivery of merchandise, on the occasion of the docker's strike in London. Only a few months ago several gas companies in Australia suffered both for want of material and laborers on account of a strike that arose entirely outside their jurisdiction. In a similar manner the railway strike has caused great anxiety to several gas companies in Scotland, by leaving them to draw the consumption of coal from stock, just at the time of maximum consumption, when most people prefer to keep a good supply on hand. Those who happened to be rather short at the beginning of the disturbance are placed in a most unenviable position. It appears that those who treat their servants well, and thus keep them contented and steady, are never safe from anxiety and risk of loss by reason of the action of outsiders. And this sort of thing is likely to go on until some clever financier can introduce a scheme that admits of paying every man a little better than everybody else.

Messrs. Bradbury & Hirsch, of Liverpool, have issued their usual annual circular on the state of the sulphate market. They point out that the price of sulphate has declined somewhat during the year. It commenced at £12 per ton, and gradually decreased throughout the year—with the exception of a little recovery of lost ground in the autumn—until it stood at £10 14s. 0d. at the close. I gather from the same source that the annual production of sulphate is now about 140,000 tons, of which gas works produce 106,000, iron works 6,000 shale works, 24,500, and coke works, 3,000. Coal gas is evidently the only industry in which anything approaching a complete utilization of all the ammonia produced is prevailing. Of the quantity above named only about one-third is used in this country, the remainder being exported mostly to various European countries. And yet the British agriculturist continues to import nitrogenous manures at high prices. The present price of sulphate is the lowest that has obtained during the last four years.

Gas and Electricity.

The following paragraphs are abstracted from the address recently delivered by the President (Mr. John West) of the Manchester (Eng.) Association of Engineers:

It will be fresh in the memory of my hearers that the question dealt with in my address last year was a comparison of the cost of lighting by gas and by electricity, and I then promised, at some future time, to return to the subject and extend the information. Shortly after our last meeting, at which you did me the honor of re-electing me President for another year, I was casting about for a subject to treat of in the present address, and bethought me of my promise; but, on consideration, I really could not see how I could extend the information then given, for the past year appears to me to have been marked by no important discovery tending to alter the figures I gave in my last address. Electricians have spent the year in discovering that there are limitations to the possibilities of electric lighting under the systems now used; consequently, we read of several leading physicists suggesting to inventors the possibility of producing those almost innumerable vibrations which are the cause of light phenomena by some more direct method, whereby light only, and no heat, shall be generated. Up to the present we know of no really satisfactory way of producing light except by heat; and when we are told that 95 per cent. of the energy we use to produce light is thrown away as heat, we see how vast is the field for improvement. It is reported that Edison has recently said that no great advance in the direction of rendering electricity a truly cheap and efficient servant of mankind can be made until some means are devised whereby the energy to be obtained from coal can be set free directly as electricity, without first passing through the various stages of chemical combination developing heat, heat causing work in an engine, and mechanical work being re transformed into electric energy by a dynamo. Probably these two objects will be achieved ultimately, but I have to deal with facts which are now practical, and likely to be useful to my hearers.

Returning, then, to the results of the accumulated experience of the past year, I am glad to say that my figures have been verified time after time, and found to be thoroughly reliable and fair. Sir David Solomon, a gentleman who was a very early patron of the electric light and who has had great experience of it from the commencement of its hold upon the public, and who has published a valuable book in its interest, has recently stated, at the Institution of Civil Engineers, that "whatever might be said to the contrary, it was impossible to see at night time without equal effect unless obscured 16-candle power glow lamps replace a 5 cubic feet gas burner." He points out that although an 8-candle power glow lamp

in a clear globe may have been shown to produce as much light as the average 5-cubic-foot gas burner, yet it did not follow that an 8-candle power glow lamp could be used with equal effect to replace a 5-cubic-foot gas burner for the nature of the light was very different. The electric lamp gave a light of greater intensity but much less diffusion, and it was better to use a frosted or obscured globe, though 16 or 17 per cent. of the light was thereby lost, because the extra illuminating surface of the frosted globe and the greater diffusion more than compensated for the loss.

Judging by the eye alone, I have often maintained that what is called a 16-candle power glow lamp does not give any more illumination than is got from an 8-candle power gas flame, and it is satisfactory to have this authority confirming one's impressions. It appears, also, that the past year has settled another point with reference to incandescent lighting. One authority after another has come forward during the year to state that the glow lamp is practically at its limit of perfection, since lamps were quite as efficient years ago as they are to-day. It is true that lamps are now produced which have an efficiency, when new, of 3 to 3½ watts per candle power, but if driven at that rate for any length of time their life is extremely short, and it is only possible to get an average of 5 watts per candle if the lamp is to last anything like the 1,000 hours generally calculated upon. There was a time not many years ago when electricians used to count upon getting 10 lamps of 16-candle power from each indicated horse power at the central station; the figures quickly fell to 8; and I was informed only the other day, by a friend who is at the head of a large modern central station generating plant, that his average was but a fraction over 6 lamps per indicated horse power.

In spite of the grumbling of customers because of the great deficiency of current and potential in London during the recent dark and foggy weather, I cannot say that the electrician has anything but a most indulgent patronage to deal with. What would be said—and done—to a London gas company if, during a re-arrangement of its plant, a workman should cause such damage as would necessitate the total suspension of lighting for a whole fortnight? Yet the patrons of the Electric Supply Corporation seem to have made but little fuss about being deprived of their light for that period owing to the fire at the Grosvenor Gallery. And when it is known that 16 candle power lamps give their 16 candle light at 100 volts pressure, and only 12-candle power when the pressure is reduced to 97 volts, it will be admitted that the customers of the Chelsea Company have some cause to complain at the margin of 3 volts allowed by the Board of Trade. The gas companies in London are fined for supplying gas which, when tested at one office out of several, falls below 16 candles by ever so small an amount, yet one at least of the electric light companies appears to have a margin of 4 candles.

I am informed that the Manchester Corporation, having obtained power from the Board of Trade for the purpose, is about to start a large central station for the supply of electricity to parts of the city. Those of us who are citizens, gas consumers, and ratepayers, are very much interested in the progress of our gas undertaking, and should urge the Council to make any electric installation totally distinct from the Gas Department, or from any other department of the Corporation, so that the ratepayers, and all others interested, may see the exact amount of profit or loss, just as they can now do by an inspection of the accounts of the Gas Department. I think I shall be able to show that various interests are involved in this subject. At the present time the Gas Department is deriving profits from the consumers of gas, who, of course, are now paying their fair proportion toward the public lighting and rates of the city. The profit made by the Gas Department is passed on to the funds of the city, and the rates are, therefore, lower than would be the case if no profit were made. If, therefore, the electric light supersedes gas in a certain area, the profits now derived from that area may be sacrificed; and unless those using the electric light pay such a price as will secure the same profit to the Electric Light Department as that previously received by the Gas Department, the difference will indirectly come from the gas consumers, or some other source. If, however, the same profits are derived from the users of electricity, it becomes immaterial to the Corporation which illuminant they supply to the public; but if this is not carried out I fear that the consumers of gas, who already pay a proportion of the rates of the non-consumers, will also have the additional burden imposed upon them of paying a portion of the electric light users' rates as well. The Council has, very recently, relieved the Gas Department of the burden of the public lighting of the city by reverting to the old plan of direct taxation, so that the non-consumers and electric users will, very properly, be called upon to pay their fair share of the lighting rate in the future.

I must again take the opportunity of impressing upon the gas consumers the desirability of economically improving their present antiquated system of gas lighting by adopting the modern regenerative or other burners, whereby they can ventilate their rooms and get an equivalent light at from 2½ to 3½ times less cost (after allowing a very large margin for defective burners) than the Corporation would be able to supply the electric light for from a large central station, as the following calculations will show:

Incandescent Lamp.

16-candle power lamp lasts 1,000 hours, and absorbs 60 units of electricity, at 8d. per unit..... .....= 40s.

Ordinary Gas Burner with Manchester Gas.

16-candle power is equivalent to 4 cubic feet of gas per hour, or 4,000 cubic feet in 1,000 hours, cost of which at 2s. 6d. per 1,000 cubic feet.....= 10s.

In the above calculation I have assumed that the Corporation charge the Board of Trade limit of 8d. per unit for the electric light; and even at that figure I have grave doubts if they would be able, after paying working expenses, repair and maintenance, and providing for a sinking fund, to hand any profits over to the Council, as at present done by the Gas Department.

Mr. West proceeded to allude to many of the purposes, other than lighting, to which electricity may be applied, and added: From observations I have made, my opinion is that if the same amount of time and trouble had been spent, during the past decade, in applying electricity to power purposes as have been spent in efforts to supersede gas and oil, electricians would have met with much greater success, and capitalists would have made a better return for their money. At first sight, perhaps, there does not seem to be so much scope, but on further thought the apparent opportunities expand themselves into ever increasing multitude.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the shareholders of the Evansville (Ind.) Gas and Electric Light Company the following Directors were chosen: Frank J. Reitz, Robert K. Dunkerson, Samuel Bayard, Thomas E. Garvin, Jacob Eichel, John Gilbert, and Jacob Weintz.

The above announcement may with appropriateness be followed by the report of the annual meeting of the Paducah (Ky.) Company, in that our Evansville friends are very largely interested at the last-named point. The Directors chosen were: John Gilbert, R. K. Dunkerson, Samuel Bogard, L. Lowenthal, F. J. Reitz, J. C. Cobb, and Charles Reed. The Paducah Company made great headway during the year, and it is in order that plant extensions may soon be heard from in connection with the works.

Senator Mahoney is responsible for the introduction in the Upper House of the California Legislature of a bill to regulate gas rates in San Francisco at the uniform figure of $1 per 1,000 cubic feet. The power to fix gas prices in that city is now vested in the local Board of Supervisors. Unless things have changed greatly for the better in the instances of cost of crude material and labor, respectively, in Frisco within the last two months, it is a positive fact that gas in the holder would cost the San Francisco Companies over $1 per thousand, to say nothing at all about distribution charges and an allowance for a bit of profit. Mahoney ought to be—mayhap he is—a man with a process.

One of the officers of the Berlin Iron Bridge Company, of East Berlin, Conn., writing to us under recent date respecting the fact that we have from time to time made mention of some of the Company's contracts, adds: "The business of the Company has increased so rapidly in the last few years that the stockholders deemed it advisable (at the annual meeting, held Jan. 19) to increase the capital stock from $125,000 to $300,000, which entire increase was at once subscribed for by the present shareholders. The additional capital will be used to improve the plant at East Berlin, where the Company will immediately put up a new building, 80 feet wide by 600 feet long, the same to be equipped with machinery and be in running order by the 1st of July, 1891. During the past few years the Company has been compelled to run its works day and night during the greater part of the time, but the new buildings and improved facilities will enable it to put out 25 per cent. more work than formerly, and only take up 10 hours of the 24. During the past year 8,000 tons of iron work, consisting of iron mill buildings, iron bridges, and iron roofs, was shipped to different points—in fact, it was distributed to almost every State of the Union. The total value of the output was almost, if not quite, $1,000,000. Regular agencies for the

Company are located at the following points: Binghamton and Buffalo, N. Y.; Pittsburgh, Pa.; Dayton, Ohio; Omaha, Neb.; Enterprise, Miss.; and San Antonio, Texas. The two great factors that attest the Company's prosperity are: The increasing demand for its specialties and the taking up of its new issue of capital stock by the present shareholders."

At the annual meeting of the Selma (Ala.) Gas and Electric Light Company the following officers were elected: President and Treasurer, John R. Kenan: Manager and Superintendent, H. Harthan; Directors, John R. Kenan, S. H. Pitts, W. P. Armstrong, W. R. Nelson, and C. W. Hooper. Those acquainted with the gentlemen named will have no difficulty in determining that the executive management of the old Selma Company is of a decidedly religious cast, hence the residents ought to have great confidence in the monthly registration of the meters.

The proprietors of the Dover (N. H.) Gas Company have declared a semi-annual dividend of 3 per cent.

There is a place in New York State that is known on the map as Long Island City, and it is notable for three things. First, it is largely dominated by the Standard Oil Company, which covers acres of it with its aromatic refineries; second, Mr. Austin Corbin's railroad is supposed to end there—nobody has yet been able to discover where Mr. Corbin's aforesaid railroad begins; third, it is governed by a Mayor, whose delight seems to be to sign himself Pat. Gleason—that is, when he is not fulminating explosive documents all going to show that the only honest man in Long Island City is the aforesaid Pat. Gleason. As a means of incidentally diverting himself, when not spotting collectors of fares on a horse railroad in "the city" which he is supposed to control, he pummels men very much out of his class in weight and prize-ring tactics, preferably newspaper men, with a tendency to consumption or rheumatism, etc. All of which goes to show that Pat. Gleason is not very much of a gentleman. It is now perhaps a matter of a month or so since the aforesaid has figured in the local prints, either as the hero of a barroom brawl or the leader of an axe brigade, hence something had to be done. In his despair he pounced upon the local gas company—unlike his horse car company tactics, the Gas Company always paid its men and promptly settled with the merchants who sold it supplies—and directed that the price of gas should be lowered. Mayor Pat. Gleason was laughed at by the Company, the proprietors of which said they would only be too glad to reduce the rates, did the business they were transacting warrant such a move. Mayor Pat. Gleason thereupon determined that he would appeal to the Legislature, in consequence whereof a "little bill" of his was sent to Albany directing that the State order a reduction in the gross selling rate for gas in Long Island City from $2 to $1.50 per 1,000. In the meantime, the Legislature up in Albany will be hard set to acquiesce in Mayor Pat. Gleason's demands in this respect, for, in the attempt to evade the special legislation provision much difficulty will be experienced in causing Long Island City to figure in a list of cities "of a certain number of inhabitants" without interfering too much with other districts that might not be in touch with Mayor Pat. Gleason's latest ambition.

Mrs. James H. Boardman, of Jackson, Mich., has instructed her attorney, Mr. T. A. Wilson, to institute a suit for damages against the Jackson National Gas and Fuel Company. Plaintiff alleges that defendant, in the fall of 1889, laid on a supply of fuel gas to the house adjoining hers, and that, because of the faulty connections provided by the Company, the gas entered her house, and "came near costing complainant her life." She sues for $10,000.

At the annual meeting of the Yonkers (N. Y.) Gas Light Company, Mr. Thos. C. Cornell was re-elected President and Treasurer, and Mr. James D. McIntyre was chosen Secretary.

On the petition of Messrs. Borum, Davenport & Co., Agents of the Tide Water Oil Company, Judge Fort recently appointed Major Felder as Receiver of the Americus (Ga.) Gas and Electric Light Company. The Receiver at once started up the electric portion of the plant, and it is thought that gas will be turned on before long.

The following officers have been elected by the proprietors of the Peoples (Manchester, N. H.) Gas Light Company: President, John B. Varick; Vice-President, Frank Dowst; Treasurer, Walter G. Africa; Clerk, Alonzo Elliot.

Mr. A. F. Bigelow, Superintendent of the Allentown (Pa.) Gas Company, has been authorized by the proprietors to announce that hereafter the gross rate for gas for illuminating purposes shall be $1.80 per 1,000 cubic feet, prompt payment (within 10 days of presentation of bills) to secure a rebate of 20 cents per 1,000. All gas sold for fuel purposes is to be billed at $1.60 per 1000, prompt payment to entitle users to a rebate of 20 cents per 1,000.

The authorities of Pittsburgh, Pa., now that the sister city of Allegheny owns and operates a municipal plant for the carrying on of the public electric lighting, are agitating the project of committing the "Smoky City" to a like course. The contract under which the public electric lighting of Pittsburgh is performed will not expire until April 1, 1892.

Some time ago we noted that the residents of Warren, O., were very skeptical over the candle power of the electric lights (nominal, 2,000-candle) furnished under contract to the city on the streets by the local electric lighting company. Further, that the authorities in deference to public opinion had determined to carry on an examination of the arcs, to settle the question of their actual lighting value. The expert selected was Prof. Benjamin Thomas, of the Ohio State University, and in due time that gentleman submitted the following report:

"* * * M. O. Messer, Esq., Chairman of Council Committee on Light, Warren, O.— * * *. The necessary parts of the University photometric apparatus were taken to Warren on January 9th and set up in Mayor Smith's office. The photometer is of the Bunsen form, with a Leeson star disc. In measuring the candle power of the lights, an arc lamp was placed at a convenient distance from the photometer, and balanced against the light of an incandescent lamp, the current through which was passed also through a Siemens electro-dynamometer and a long iron wire, a movable contact piece being used to vary the length of wire in circuit so as to keep the current through the incandescent lamp constant, which was done to one part in 500, in all the tests. The candle power of the incandescent lamp was determined by comparison with a Methven screen, a form of standard gas burner commonly used for such work. The candle power of the Methven was separately determined by comparison with standard sperm candles corrected for rate of burning. The 'standard candle,' as defined by the laws of Ohio, was, therefore, the ultimate standard used. All parts of the apparatus were carefully screened, and all the work was done in accordance with the best scientific practice. * * *. The eight arc lamps tested were taken from their usual places on the street circuits, brought directly to the testing rooms and put into a loop from the street circuit, in order that the lamps might be tested with the same current that was passing through the street lights at the time the test was in progress. Four of the lamps were selected by those who were said to be dissatisfied with the light, and four more were then chosen by the Company operating the light, or by their friends; the purpose being to secure a fair average among the lamps used in the city. The current passing through the lamps was measured by a Siemens electro-dynamometer, and the difference of potential at the carbons by a Cardew voltmeter. The dynamometers and the voltmeter were carefully tested at the University and found to be correct. In testing, several readings were taken on one side of each lamp, the lamp turned half way round, and as many more readings taken. Readings were taken for the highest, the lowest and the average candle power given by the lamp under test. The candles, corrected for rate of burning, gave an average of 995 thousandths of a standard candle power. From this, the average power of the Methven screen was found to be 2.01 candles, and from this the average power of the incandescent lamp was 35.9 candles. The following are the results of the measurements of the arc lamps:

	Electrical Data.			Candle Power.			
No.	Amp.	Volts.	Watts.	Max.	Min.	Average.	Remarks.
1..	11.4	55.3	550	590	230	385	—Very unsteady.
2..	10.1	52.0	525	1,300	260	605	
2..	10.4	50.0	518	1,700	374	889	—Very steady.
3..	10.6	43.3	459	1,580	455	850	—Steady and white.
4..	10.8	42.0	454	1,500	324	716	—Unsteady.
5..	—	—	—	1,120	300	605	—Shadow zone.
6..	11.6	43.0	499	1,500	320	777	—Unsteady.
7..	11.8	54.0	637	1,900	350	1,036	—Excellent.
8..	11.1	53.0	588	1,700	396	835	—Steady.

"After taking the readings on one side of the first lamp, I noticed that there was a region, which I called the shadow zone, extending horizontally from the arc, in which the light was much weaker than above or below. The zone was observed in all the lamps. The first readings on No. 1 lamp were taken with the arc on the same level as the photometer bar, and the measurement gave, therefore, the strength of the light in the shadow, which was evidently less than that which would have been thrown on the street by the lamp at the time. The second readings were

taken after raising the lamp 2 or 3 feet, so that the shadow should be above the bar. All the other lamps were measured in the same position. In the above figures, those under 'maximum' and 'minimum' were obtained in the attempt to catch the strongest and weakest light given by the lamp under test, and represent a single reading in each case. Several maximum and several minimum readings were taken on each lamp, and the highest and lowest readings obtained were used. In the readings for average candle power, from 10 to 20 readings were taken at times when the arc seemed to be giving its steadiest light, and the average used. The position of the arcs, slightly above the level of the photometer bar, was that in which the representatives of the Company considered the light to be strongest. * * *.—BENJAMIN F. THOMAS."

OWING to the re-arrangement of the gas lamps at Toronto, Canada, caused by the adoption in that city of a greatly increased number of arc lights on account of public lighting, the Gas Company has been obliged to notify 32 lamplighters that their services would be no longer required. Sixteen of the men were discharged on January 20, and the others are to go out to day. In noteworthy contrast to the usual practice of large manufacturing companies in similar instances, the Directors of the Consumers Gas Company voted that Manager Pearson be handed the sum of $1,000, with instructions to pay it out in weekly sums to each of the discharged men, until the fund was exhausted; Mr. Pearson to have the right to determine the individual allotment per week. This is certainly a most praiseworthy action.

THE suit brought by Dr. S. A. Baxter, of Lima, O., against the St. Paul (Minn.) Gas Light Company, has been decided, by a jury in the United States Circuit Court for the district, in favor of the plaintiff, and damages were assessed at $54,168.30. The history of the case may be thus summarized: On November 22, Dr. Baxter, acting as an officer and agent of "The National Oil Company, of Lima, O.," executed a contract with the St. Paul Gas Light Company, under which the latter agreed to receive in suitable quantities and at appropriate times, 5,000,000 gallons of "National Gas Oil," at the rate of 3¼ cents per gallon. Between November 25 and 30 of the year named the plaintiff shipped to and the defendant received and paid for 6 carload lots of the oil. On December 3, just before the second installment of oil under the agreement was due, Mr. Ellison, Superintendent of the Gas Company, notified the Oil Company not to "ship any oil the coming week," offering as a reason for the request that the Company's oil storage capacity was not so large as he (Ellison) estimated, and that further advices in respect to future shipments would be mailed in the week following. The advices finally came to hand in the shape of a notification that the Gas Company would not receive any more oil under the contract, and that the latter was to be considered terminated. In February last Dr. Baxter instituted suit for the difference between 2.16 cents (the cost to him of the oil laid at the Gas Company's works) and 3.25 cents (the contract rate) per gallon. The Gas Company, in defending, said that plaintiff alleged that the National gas oil was superior to ordinary Lima crude oil as a gas making material, but that practice at the St. Paul Company's works showed this to be an error. Plaintiff denied any such representation, and defendant failed to prove by witnesses that plaintiff had so asserted. Other interesting facts were elicited in the trial, but sufficient indication is here afforded of the main points in the complaint and defense. The Court granted a stay of judgment to permit defendant's attorneys to perfect an appeal.

THE following officers were chosen at the recent annual meeting of the Citizens Gas Light Company, of Warsaw, N. Y.: President, S. D. Lewis; Vice-President, John Harrigan; Secretary, J. B. Gates; Treasurer, B. F. Fargo; Directors, J. G. Hulett, L. W. Pettibone, Augustus Frank, L. W. Thayer, E. E. Farman, L. H. Humphrey, S. D. Lewis, John Harrigan, and J. B. Gates.

WE notice that among the late contributions to the Providence (R. I.) Public Library shelves was a copy of Mr. H. C. Adams' recent work on "The Gas Coals of the United States." The donor was Mr. Samuel G. Stiness, of Pawtucket.

THE proprietors of the Atlantic City (N. J.) Gas Company will put down at once 1,500 feet of 20-inch main, through Ohio avenue, for the purpose of improving the pressure conditions. This Company's success is little short of phenomenal. And the best of it all is that the increase shows no sign of nearing the maximum.

THE Hon. Mr. Costigan, of Canada's Parliament, is preparing a bill which will establish a standard, and means for enforcing the same, respecting the candle power of electric lights in the Dominion.

IT looks as if the Equity Gas Light Company, which has the charter right to operate a gas works and lay mains in the district bounded by the 19th, 16th and 18th Wards of the city of Brooklyn, will speedily become an accomplished fact. In any event, Mr. Henry C. Fanshawe, of this city, well known in gas circles from his connection with the Bay State Gas Company, has become interested in the project, and, from our knowledge of the man, he usually knows what he is about, and is in this instance thoroughly well posted. The works of the Company are to be located at a point on the old Newtown creek close to Maspeth avenue. The capital stock of the Company is $2,000,000, and a water gas plant will be installed.

AT the annual meeting of the Houston (Texas) Gas Light Company the following officers were chosen: President, T. W. House; Vice-President, T. H. Scanlan; Secretary, Treasurer, and General Manager, G. H. Vaughn; Superintendent, J. Gill; Directors, T. W. House, B. A. Shepherd, Henry S. Fox, T. H. Scanlan, and John T. Brady.

MR. RICE, of the Kansas State Legislature, nas presented a bill which directs that the affairs of the gas, electric light and water companies of the State shall be placed under the supervision of the State Board of Railroad Commissioners. The Board is to have power to fix rates, adjust complaints, etc., and the statute also provides that the several companies shall submit an annual report (itemized) of their operations. The plan of the bill is evidently based on the Massachusetts measure under which the Gas and Electric Light Commission of that State is maintained.

MAYOR TYLER, of Louisville, Ky., has appointed Mr. John W. Breeden to the position of Gas Inspector, vice Col. Phil. Bate. Mr. Breeden's chief qualifications for the place seem to be that he is a warm personal friend of the Mayor, and that he is in the insurance business. In fact, Mayor Tyler and Mr. Breeden were at one time partners in that line.

AT last the organizers of the Consumers (or opposition) Gas and Electric Light Company, of Saratoga Springs, N. Y., have carried their point, in that their franchises and property have been purchased by the old Saratoga Gas and Electric Light Company. The old, old story.

THE Framingham (Mass.) Gas, Fuel and Power Company has turned on its gas and is supplying a non-luminous water gas to the people. The Loomis machines are employed and Welsbach burners are used. The Company has applications for 296 meters, and the rate charged is 60 cents gross (net, 50) per 1,000 cubic feet, where the gas is used for both lighting and heating. Where it is used for lighting purposes only, the rate is 75 cents per thousand.

THE Gas Light Company of Augusta, Ga., has declared a semi-annual dividend of 3 per cent. Hookey is still at the forward end of the rope.

RECENT advices from Washington (D. C.) are to the effect that in the local court in General Term (before Judges Bingham, James and Montgomery) a case is now before them, brought up on exceptions, in which the District of Columbia pravs to recover from the Washington Gas Light Company. The case hinges on the right of the District to recover from the Gas Company the amount of judgment awarded and paid to Mrs. Marietta Parker, by the District, some years ago on account of personal injuries then sustained by her. On the 10th of January, 1879, Mrs. Parker, while walking along C street, northeast, in the city of Washington, stepped into an open gas drip-box on the sidewalk, thereby sustaining severe and permanent injuries. In July of the same year she brought suit *against the District*. The case was reached and tried in December, 1880, and eventually plaintiff was paid $5,000. The District now seeks to recover this from the Gas Company.

A WAR of gas rates is on at Rochester, N. Y., the proprietors of the Citizens Gas Company having, on the 22d of January, announced their intention to sell gas at 75 cents per 1,000 cubic feet, "until further notice," at any rate. The Company alleges that the Municipal Company has been quietly cutting rates to large consumers for some time back, despite the agreement made at the time the territory was divided that a uniform schedule should be maintained. The Municipal Company has about 12 miles of main on the east of the Genessee river, which is the territory ceded by the old Rochester Company to the Citizens Company, under the agreement of 1873.

MR. W. A. MILLER, of the Philadelphia Common Council, asks that an ordinance be adopted putting the rate on gas used for illuminating purposes at $1 per 1,000; gas used for fuel to be supplied at the rate of 75 cents per 1,000.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

EDITOR—Jos. R. Thomas, C.E.
ASST. EDITOR—T. J. Cunningham.
MANAGER—C. E. Sanderson.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.

This is a recognized official organ of
LIGHT, HEAT, STEAM, WATER SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE

TERMS:
SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 cents.

AGENTS.
NEW YORK.—AMERICAN NEWS CO., 39 and 41 Chambers Street.
Germany.—B. WESTERMANN & CO., of New York.

MONDAY, FEBRUARY 2, 1891.

The Market for Gas Securities.

The city gas share market presented no features out of the common during the week. The trading in Consolidated lacked volume, but transactions were effected at a slowly increasing rate, the opening trade to-day (Friday) having been made at 95½, and that figure was freely bid for more stock. Equitable seems inclined to recover from its sluggishness, and Mutual also feels the impulse of renewed confidence. Bay State, of Boston, is at 60 to 61 and is cheap at the asking price, for it is quite likely that the last half of the current year will mark its appearance in the list of dividend payers. Chicago gas was as volatile as ever during the week, depression marking the first days, whereas strength was the characteristic symptom at the close. The opening price to-day was 42½–¾. The reports of semi-annual dividends on various gas shares come in with digusting (according to our electrical friend's ideas) regularity; and from the tenor of the advance estimates made by the various boards of direction it would seem that 1891 is to be the banner gas year of the century.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

FEBRUARY 2.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	96½	96¾
Central	500,000	50	—	85
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	115	118
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	117	120
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	—	48
Preferred	5,000,000	100	—	90
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	116	118
Citizens	1,200,000	20	85	90
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	131	135
" Bonds	300,000		100	105
Peoples	1,000,000	10	90	92
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	103	107
Nassau	1,000,000	25	130	—
" Ctfs	700,000	1000	95	100
Williamsburgh	1,000,000	50	128	130
" Bonds	1,000,000	—	108	112
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	—	87
2d " " "	3,000,000	1000	—	75
Bay State Gas Co.—				
Stock	5,000,000	50	60	61
Income Bonds	2,000,000	1000	95½	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds	45,000	—	—	—
Chicago Gas Company	25,000,000	100	42½	42¾
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	100	84¾	85½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	98
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	94	98½
Consumers Gas Light Co., Jersey City	2,000,000	100	12	15
Bonds	600,000	1000	70	75
Cincinnati G. & C. Co.	6,500,000	100	204	205
Consumers Toronto	1,000,000	50	190	200
Central, S. F., Cal.			92	100
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	47	47½
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	110
Bonds	250,000		—	—

Advertisers Index.

GAS ENGINEERS. Page

Jos. R. Thomas, New York City ... 169
Wm. Henry White, New York City ... 175
Wm. Mooney, New York City ... 169
Fred. Bredel, N. Y. City ... 171

CHEMISTS.

Durand Woodman, New York City ... 169

GAS AND WATER PIPES.

Gloucester Iron Works, Phila., Pa ... 169
Mellert Foundry and Machine Co., Reading, Pa. (John Fox, Selling Agent, N. Y.) ... 169
Ohio Pipe Co., Columbus, Ohio ... 169
M. J. Drummond, New York City ... 169
R. D. Wood & Co., Phila., Pa ... 174
Warren Foundry & Machine Co., New York City ... 169
Donaldson Iron Co., Emaus, Pa ... 169
Dennis Long & Company, Louisville, Ky ... 169
Spiral Weld Tube Company, New York City ... 169

PROCESSES.

National Gas Light and Fuel Co., Chicago, Ills ... 166
Bartlett, Hayward & Co., Baltimore, Md ... 173
United Gas Improvement Co., Phila., Pa ... 165
Burdett Loomis, Hartford, Conn ... 161
American Gas, Light and Heat Co., Phila, Pa ... 159

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City ... 175
Continental Iron Works, Greenpoint, L. I ... 175
Delly & Fowler, Phila., Pa ... 175
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 172
Stacey Mfg. Co., Cincinnati, Ohio ... 175
Bartlett, Hayward & Co., Baltimore, Md ... 173
Morris, Tasker & Co., Limited, Phila., Pa ... 173
Davis & Farnum Mfg. Co., Waltham, Mass ... 172
R. D. Wood & Co., Phila., Pa ... 174
Bouton Foundry Co., Chicago, Ills ... 175
Isbell-Porter Company, New York City ... 174
Fred. Bredel, N. Y. City ... 171
United Gas Improvement Co., Phila., Pa ... 165
National Gas Light and Fuel Co., Chicago, Ills ... 166
Berlin Iron Bridge Company, East Berlin, Conn ... 161

INCLINED RETORTS.

Laclede Fire Brick Manuf'g Co., St. Louis, Mo. ... 128

GASHOLDER TANKS.

W. C. Whyte, New York City ... 166
J. P. Whittier, Brooklyn, N. Y. ... 167

GASHOLDER PAINT.

The Government Waterproof Paint Co., Boston, Mass ... 161

RETORTS AND FIREBRICK.

J. H. Gautier & Co., Jersey City, N. J ... 170
B. Kreischer & Sons, New York City ... 170
Adam Weber, New York City ... 170
Laclede Fire Brick Manuf'g Co., St. Louis, Mo. ... 170
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y ... 170
Borgner & O'Brien, Phila., Pa ... 170
James Gardner, Jr., Pittsburgh, Pa ... 170
Henry Maurer & Son, New York City ... 171
Chicago Retort and Fire Brick Co., Chicago, Ills ... 170
Baltimore Retort and Fire Brick Co., Baltimore ... 170
Oakhill Gas Retort and Fire Brick Co., St. Louis, Mo ... 170
Boston Fire Brick Works, Boston, Mass ... 170

SCRUBBERS AND CONDENSERS.

G. Shepard Page, New York City ... 123
R. D. Wood & Co., Phila., Pa ... 174
James R. Floyd & Sons, New York City ... 168

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md ... 173
Fred. Bredel, New York City ... 171
Chicago Retort and Firebrick Co., Chicago, Ills ... 170
J. H. Gautier & Co., Jersey City, N. J ... 171
Adam Weber, New York City ... 162

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City ... 167
Fred. Bredel, N. Y. City ... 171
Friedrich Lux, London, England ... 62
Wilbraham Bros, Phila., Pa ... 167

SELF-SEALING MOUTHPIECE DOORS.

Ibsell-Porter Company, New York City ... 174
Continental Iron Works, Brooklyn, N. Y ... 160

TAR AND CARBONIC ACID EXTRACTOR.

Geo. Shepard Page, N. Y. City ... 159

CEMENTS.

C. L. Gerould & Co., Brooklyn, N. Y ... 170

GAS ENRICHERS.

Standard Oil Co., Cleveland, Ohio ... 176

GAS METERS.

John J. Griffin & Co., Phila., Pa ... 178
American Meter Co., New York and Philadelphia ... 179
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa ... 179
Helme & McIlhenny, Phila., Pa ... 179
D. McDonald & Co. Albany, N. Y ... 179
Nathaniel Tufts, Boston, Mass ... 178
Maryland Meter and Manufacturing Co., Baltimore, Md ... 178
Harris Bros. & Co., Philadelphia, Pa ... 178

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind ... 164
Isbell-Porter Company, New York City ... 174
Wilbraham Bros., Philadelphia, Pa ... 167
Connelly Iron Sponge and Governor Co., New York City ... 167

GAS COALS.

Penn Gas Coal Co., Phila., Pa ... 177
Perkins & Co., New York City ... 176
Despard Coal Co., Baltimore, Md ... 177
Chesapeake and Ohio R. R. Coal Agency, N. Y. City ... 177
Westmoreland Coal Company, Phila., Pa ... 177
J. & W. Wood, New York City ... 176

CANNEL COALS.

Perkins & Co., New York City 176
J. & W. Wood, New York City 176

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y 160
Chapman Valve Manufacturing Co., Boston, Mass 160
R. D. Wood & Co., Phila., Pa 174
The P. H. & F. M. Roots Co., Connersville, Ind 128

GAS ENGINES.

Schleicher, Schumm & Co., Phila., Pa 144
Clerk Gas Engine Co., Phila., Pa 177
Van Duzen Gas Engine Co., Cincinnati, Ohio 177

ENGINES AND BOILERS.

Jarvis Engineering Co., Boston, Mass 167

STEAM PUMPS.

Van Duzen & Tift, Cincinnati, Ohio 160

GAS LAMPS.

Fiske, Coleman & Company, Boston, Mass 170

PURIFIER SCREENS.

John Cabot, New York City 162

GAS STOVES.

American Meter Co., New York and Philadelphia 163
The Goodwin Gas Stove and Meter Co., Phila. Pa 180
George M. Clark & Company, Chicago, Ills 162
D. McDonald & Co., Albany, N. Y 179
Maryland Meter and Manufacturing Co., Baltimore, Md 178
Chicago Gas Stove Company, Chicago, Ills 162

STREET LAMPS.

J. G. Miner, Morrisania, New York City 161
Bartlett Street Lamp Man'fg Co., New York City 161

BURNERS.

C. A. Gefroner, Phila., Pa 176
Moses G. Wilder, Phila., Pa 161

STEAM BLOWER FOR BURNING BREESE.

H. E. Parson, New York City 162

PURIFYING MATERIAL.

Connelly Iron Sponge and Governor Co., New York City 167
Friedrich Lux, London, England 162
Hill Chemical Company, Brooklyn, N. Y 160

COKE CRUSHER.

C. M. Keller, Columbus, Ind 177

ELECTRICAL APPARATUS.

Wm. Henry White, N. Y. City 175
Fort Wayne Electric Co., Fort Wayne, Ind 168

BOOKS, ETC.

1890, Directory, 1890 167
King's Treatise 169
Practical Electric Lighting 167
Electric Light Primer 167
American Gas Engineer and Superintendents' Handbook 171
Digest of Gas Law 161
Fuel and its Applications 160
Newbigging's Handbook 171

WANTED,

A competent man as

Superintendent of Electric Light Plant and Gas Works.

State qualifications, experience, and salary expected. Address
817-1 Box 854, Washington, Pa.

Position Desired

AS SUPERINTENDENT OF GAS WORKS,

Either Coal or Water, by a man of many years' experience. Or would lease a works in a city of from 10,000 to 20,000 inhabitants. Best of references. Address
817-4 "W.," care this Journal.

POSITION DESIRED

As Superintendent of Gas Works,

By a young man fully experienced in the details of construction, manufacture, and distribution. Best of references. Address
814-tf "CONSTRUCTION," care this Journal.

Position Desired

As Superintendent of Gas, Water, or Electric Light Works,

By a man of 20 years' experience in the manufacture and distribution of gas and the construction and extension of gas plants. Can give the best of references. Address
816-4 "G. U. S.," care this Journal.

WANTED,

Second-Hand Roots Exhauster, No. 3.

With Valves and 6-inch Connections, in good order. Address
817-13 "EXHAUSTER," care this Journal.

FOR SALE,

114 Cast Iron Gas Lamp Posts,

of standard make, at a reasonable price. Address
815-3 M. GOLDBERG, Joliet, Ills.

CALIFORNIA GAS WORKS For Sale.

Several Coal Gas Plants, in both Southern and Northern California, now profitably operated and constantly increasing in value. Practical gas men, with $7,500 to $15,000 to invest, can secure controlling interest and superintendency. Very desirable places of residence. Satisfactory reasons for selling
"SECRETARY," 123 Beale Street,
807-13t San Francisco, Cal.

COAL TAR.

PROPOSALS will be received at the Office of the **Camden Gas Light Company,** No. 432 Federal Street, Camden, N. J., until March 2d, proximo, for the sale of about 1,500 bbls. (45 galls. per bbl.) of Coal Tar. Delivery as made at the Company's works, in barrels to be furnished by the purchaser. Contract to be made for a period of three or five years, with satisfactory bond. The right to reject any and all bids reserved
815-4 CHAS WATSON, Treas.

Coal Tar For Sale.

PROPOSALS for the entire make of Coal Tar at works of **Knoxville (Tenn.) Gas Light Company,** for five (5) years, the same being about 60,000 gallons per year, will be received at the Company's Office in Knoxville, Tenn. Tar to be delivered in tank cars at works. Not more than 20,000 gallons shall be allowed to accumulate in well at any one time. Right to use sufficient tar for Company's own purposes, and to reject any or all bids, reserved. The Company expects bids in the neighborhood of the price which other Companies are now receiving—viz., 10 cents per gallon.

KNOXVILLE GAS LIGHT CO.,
812-8t Knoxville, Tenn.

The American Gas, Light & Heat Co.,

OF

249 S. 6th St., Phila., Pa.,

Are now prepared to erect plants of their Oxy-Hydrocarbon Process, to carburet coal gas up to any given or named candle power required for general consumption (for instance, from 20 to 25 candles), and at a cost not to exceed one and three-quarters (1¾) cents per candle power per 1,000 cubic feet increased, with a permanent and perfectly *fixed* gas, *not a vapor*—a gas that will whiten the whole output of the works.

This gas can be furnished at a cost less per 1,000 cubic feet than the coal gas may be costing the company.

Our system is such that we can furnish plants that will carburet 50,000 cubic feet in 24 hours, or three or four million feet in the same length of time. *One* of our large benches or plants would be capable of generating 100,000 cubic feet of gas in 24 hours, which would raise the candle power on 2,000,000 feet (taking as a standard coal gas at 15 candles) 3 candles on the 2,000,000 feet, enabling the works to deliver to consumers an 18 candle gas; or, enlarging our plant, the candle power may be increased as desired, at the same cost per candle power, less interest on plant.

This is much less per candle power than it can be furnished by the use of cannel coal or by vaporizing naphtha. With our process we improve the whole output in color—viz., whiten the flame with the oxygen, as well as furnishing a *thoroughly fixed* gas, and no possible danger of separation as there is with vapor. Correspondence solicited.

J. J. NEWELL, Sec'y.

September 4, 1890.

THE WALKER TAR AND CARBONIC ACID EXTRACTOR.

A very general demand exists, in both large and small Gas Works, for an apparatus that will be absolutely efficient in the removal of the Tar which passes the hydraulic main and condenser. Many attempts have been made to accomplish this, but, I believe, without success, until the introduction, six years ago, in England, of the C. & W. Walker Patent Tar and Carbonic Acid Extractor. During these years this apparatus has been adopted by many of the most prominent Engineers, not only in England, but also on the Continent of Europe and in other parts of the world. Several have been erected in the United States.

"The C. & W. Walker Tar and Carbonic Acid Extractor has been in operation at these works for the past six weeks, and is an unqualified success. It removes every particle of Tar from the gas in once passing through the apparatus, and a large percentage of the Carbonic Acid. I also feel quite sure that it prevents the formation and deposit of Naphthaline, because since I started the Washer I have had no stoppages from this cause. These works have been seriously troubled with Tar for many years, and I have used several kinds of apparatus and every expedient which has come to my attention for dealing with the difficulty, but without success. The Walker apparatus occupies comparatively small space, is less expensive than other systems, and requires but little attention. I carry 2½-inch seal, and have an automatic tar delivery valve. This Tar Extractor is indispensable to gas makers.

"C. A. GERDENIER, Supt. Bridgeport (Conn.) Gas Lt. Co."

This Tar Extractor will perform its work with about one-fourth the usual back-pressure heretofore required. It is simple in construction, and can be supplied at a very reasonable price—less than any other ever before introduced. Satisfactory results guaranteed in every instance.

GEO. SHEPARD PAGE, Sole Agt. for the U. S., 69 Wall Street, N. Y. City.

SELF-SEALING RETORT MOUTHPIECE AND LID.

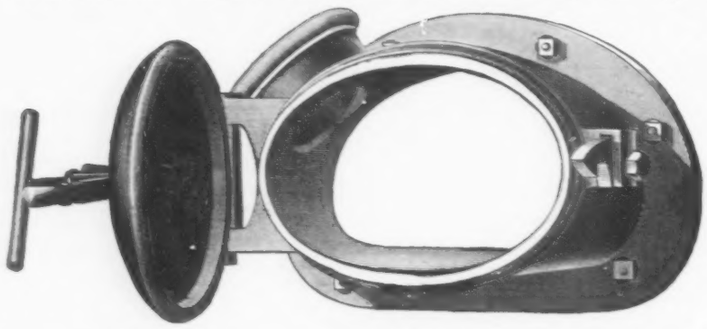
MANUFACTURED SOLELY BY

The Continental Iron Works

THOS. F. ROWLAND, President.

Take 10th or 23d Street Ferries from New York to Greenpoint. **BROOKLYN, N. Y.**

Made for Round, Oval, or "D" Retorts.



Joint made under the well-known Balmore Patent

This Mouthpiece and Lid was introduced to the public in 1884, and since then large numbers have been manufactured and sold.

The following important Gas Companies have them in use at the present time, to any of which we refer:

Charleston (S. C.) Gas Light Company.
Williamsburgh (Brooklyn, N. Y.) Gas Light Co.
Bridgeport (Conn.) Gas Light Company.
Buffalo Mutual Gas Light Company.
Palatka (Fla.) Gas Light Company.
Gainesville (Fla.) Gas Light Company.
Syracuse Gas Light Company.
Taunton (Mass.) Gas Light Company.
Providence Gas Light Company
Central (New York City) Gas Light Company.
Northern (New York City) Gas Light Company.
Stamford (Conn.) Gas Light Company.
Holyoke (Mass.) Gas Light Company.
Springfield (Mass.) Gas Light Company.

Dissolution of Co-Partnership

The firm of CONNELLY & CO. is this day dissolved by mutual consent, J. S., T. E., and J. W. Connelly retiring, and S. F. Hayward continuing the business, incorporating under the name and style of the "CONNELLY IRON SPONGE AND GOVERNOR CO.," assuming all liabilities of the late firm, and authorized to collect all outstanding accounts.

J. S. CONNELLY,
T. E. CONNELLY,
J. W. CONNELLY,
S. F. HAYWARD.

The retiring members take this opportunity to thank their many patrons for the liberal patronage they have enjoyed, and would respectfully solicit a continuance of the same for the new Company, bespeaking for them an earnest desire to please in all their dealings.

J. S. CONNELLY,
T. E. CONNELLY,
J. W. CONNELLY.

We should be pleased to receive a continuance of the favors extended to the old firm, and hope, by a vigorous, energetic pushing of the business and fair dealing, to deserve it. Thanking you in advance,

CONNELLY IRON SPONGE AND GOVERNOR CO.

December 1, 1890. 812-6

Fuel and Its Applications.

By E. J. MILLS, D.Sc. F.R.S., and F. J. ROWAN, C.E., assisted by others, including Mr. F. P. Dewey, of the Smithsonian Inst., Wash., D. C.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

DURAND WOODMAN, Ph.D.,
Analytic and Technical
CHEMIST.

Analyses of Gas, Fuel and Gas Coals, Crude and Refined Petroleum, Materials for Gas Purification, Tar, Ammoniacal Liquors and other Bye-Products, Fire Clays, Deposits in Mains, Water for Steam Making, Boiler Scale, etc., etc. Expert work in connection with "Damages to adjacent water supplies and adjoining properties." Experimental Investigations for Inventors.

127 Pearl Street (Hanover Square), N. Y.

"SUCCESSFULLY INTRODUCED."

Hill Chemical Company's
IRON MASS

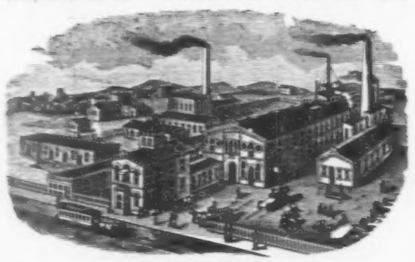
For Gas Purification.

Office, 229 Bridge Street. Works, Newtown Creek.

BROOKLYN, N. Y.

CORRESPONDENCE SOLICITED.

LUDLOW VALVE MFG. CO.



OFFICE AND WORKS,
938 to 954 River Street and 67 to 83 Vail Av., TROY, N. Y.

CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants With and Without Independent Nozzle Valve. All Work Guaranteed.

WORKS & GEN'L OFFICE: **Indian Orchard, Mass.**

TREASURER'S OFFICE: **72 Kilby & 112 Milk Sts, Boston, Mass.**

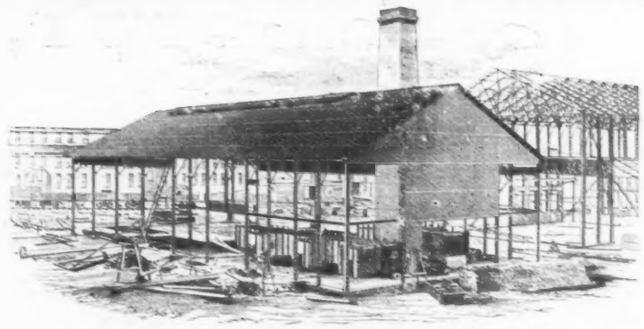
Hydraulic Main Lip Regulators, also Check Valves, Foot Valves, Yard-wash and Fire Hydrants.

Send for Circulars.

Valves.—Double and Single Gate, ¼ in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil. Send for Circulars.

THE BERLIN IRON BRIDGE CO.

Write for Illustrated Catalogue.



Write for Illustrated Catalogue.

The above illustration is taken direct from a photograph of an iron Bending Shed built by us for the Newport News Ship Building and Dry Dock Company, at Newport News, Va. The building is entirely of iron, and is therefore indestructible by fire. The building shown at the right of the illustration—the iron frame only—is a two-story Ship Shed built by us for the same Company. At the time the photograph was taken the Bending Shed was completed, but only the framework of the Ship Shed had been erected.

Office and Works, EAST BERLIN, CONN.

Agencies: WM. PAYSON, San Antonio, Tex. M. B. GRANT, Enterprise, Miss.
W. E. STEARNS, Omaha, Neb. A. M. RAWN, Dayton, Ohio.

GASHOLDER PAINT.

Use Only

THE GOVERNMENT WATERPROOF PAINT

Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

THE GOVERNMENT WATERPROOF PAINT CO., 122 Milk Street, Boston, Mass

Bartlett Street Lamp Mfg. Co.

MANUFACTURERS OF

Globe Lamps,

FOR

Streets, Parks, Public Buildings, Railroad Stations, etc.

LAMP POSTS

A Specialty.

Office and Salesroom,

40 & 42 COLLEGE PLACE, - - N. Y. CITY.

Gas Companies and others intending to erect Lamps and Posts will do well to communicate with us.

The Miner Street Lamps.

Jacob G. Miner,

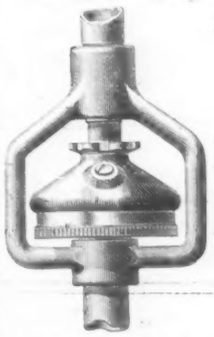
No. 823 Eagle Ave., New York, N. Y

MOSES G. WILDER, MECH. ENGR.

816-18-20-22 Cherry St., Phila., Pa.

Volumetric Lamp Governors

FOR GAS LAMPS & HIGH-POWER BURNERS.



GOVERNOR BURNERS

for

STREET LAMPS AND GENERAL USE,

and

GOVERNORS FOR ARGAND AND OTHER COMMON GAS BURNERS IN ALL SIZES.

HORIZONTAL

Governors

Specially adapted for GAS STOVES, FURNACES, Etc., Etc.

It is well known that a large majority of all High Power Gas Lamps in the United States have my Governors attached, and they are always used by the leading makers of these lamps. To remove any excuse for the use by anyone of inferior and infringing Governors, a reduction in price has been made, and all exclusive contracts are cancelled.

Correspondence Solicited with all who require a Reliable Governor.

GREENOUGH'S "DIGEST OF GAS LAW."

Price, $5.00.

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO., 42 Pine St., N. Y.

PATENTS.

FRANKLIN H. HOUGH

Solicitor of American & Foreign Patents.

925 F. ST., WASHINGTON, D. C.

(NEAR U. S. PATENT OFFICE.)

Personal attention given to the preparation and prosecution of applications for Letters Patent. All business before the U. S. Patent Office attended to for moderate fees. **No Agency in the United States possesses superior facilities for obtaining Patents,** or for ascertaining the patentability of inventions. Copies of patents furnished for 25 cents each. Correspondence solicited

Water Gas! Fuel Gas!

For all Manufacturing Purposes. Generated from Bituminous Slack, Anthracite Coal Dust, or Coke Breeze, by

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Sons' Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Utilizing any Kind of Low-Priced Coals.

NOVEL IN DESIGN, MODERN IN CONSTRUCTION, SIMPLE IN OPERATION, PERFECT IN RESULTS.

Plans and Estimates Furnished.

BURDETT LOOMIS, - - Hartford, Conn.,

Or Murray Hill Hotel, New York City.

MANHATTAN FIRE BRICK AND ENAMELED CLAY RETORT WORKS.

ADAM WEBER, Prop'r,

633 East Fifteenth St., N. Y.

Modern Recuperative Furnaces

FOR FIRING COAL GAS AND FIXING BENCHES, ALSO INCLINED AND VERTICAL RETORTS.

The most successful Furnace in America in competition with all others. Results equalled by no other Furnace, Full or Semi-Regenerative. Superior to all others in strength of construction and prolonged life of Retorts and Furnace.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR UTILIZING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., No. 54 Pine St., N. Y.

SPECIAL TRAYS FOR IRON SPONGE OR OXIDE OF IRON.

CHURCH'S TRAYS A SPECIALTY.

REVERSIBLE-STRONGEST-MOST DURABLE-MOST EASILY REPAIRED.

JOHN GABOT. TRAYS FOR GAS WORKS.

306-310 ELEVENTH AVENUE, NEW YORK.

WE ALSO MAKE THE CHEAPEST AND STRONGEST REVERSIBLE BOLTED TRAYS IN THE MARKET.

CHICAGO GAS STOVE CO.

MANUFACTURERS OF ALL KINDS OF

Gas Cooking and Heating APPLIANCES.

240, 242 & 244 West Lake St., Chicago.

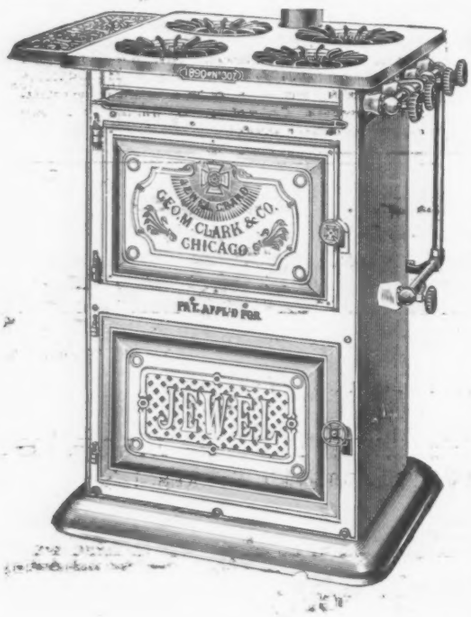
Send for Catalogue.

FRIEDRICH LUX,

Ludwigshafen am Rhein and London.

Lux Mass GAS GOVERNORS,

Gas Balance.



JEWEL GAS STOVES

MANUFACTURED BY

GEORGE M. CLARK & COMPANY,

157 & 159 Superior Street, - Chicago, Ill.

EVERY CONCEIVABLE SIZE AND STYLE.

Ranging in Prices from $1.50 to $37.00.

WE USE NO GAS COCKS.

All Flames are Regulated by a Direct Needle Valve.

The JEWEL

IS THE

Only Well-Made Gas Stove on the Market.

Write for our 1890 Catalogue and see for yourself.

Jewel Circulating Water Heater. $15.00.

GAS STOVES. GAS METERS. GAS STOVES.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

MANUFACTURERS OF

Standard 3 Diaphragm Dry Meter.

Gas Meters,

STATION METERS,

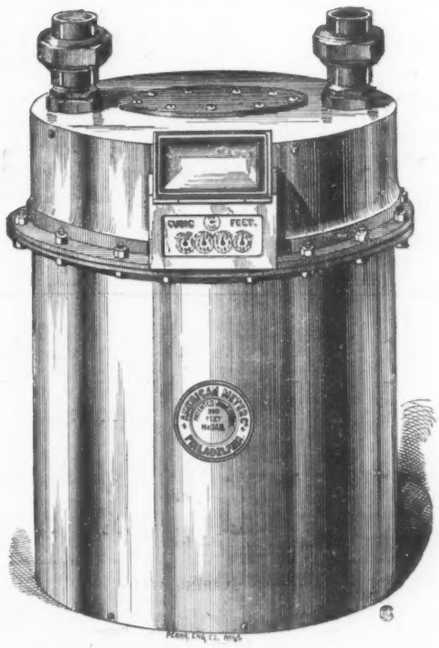
METER PROVERS, PHOTOMETERS,

Experimental Meters of all Kinds,

AND

Standard 2 Diaphragm Dry Meter.

Apparatus for Testing the Quantity and Quality of Gases.



Meters for Measuring Natural Gas.

MANUFACTORIES,

508 to 514 West Twenty-second St., N. Y. Arch and Twenty-second St., Phila.

Nos. 244 & 246 North Wells Street, Chicago, Ill.

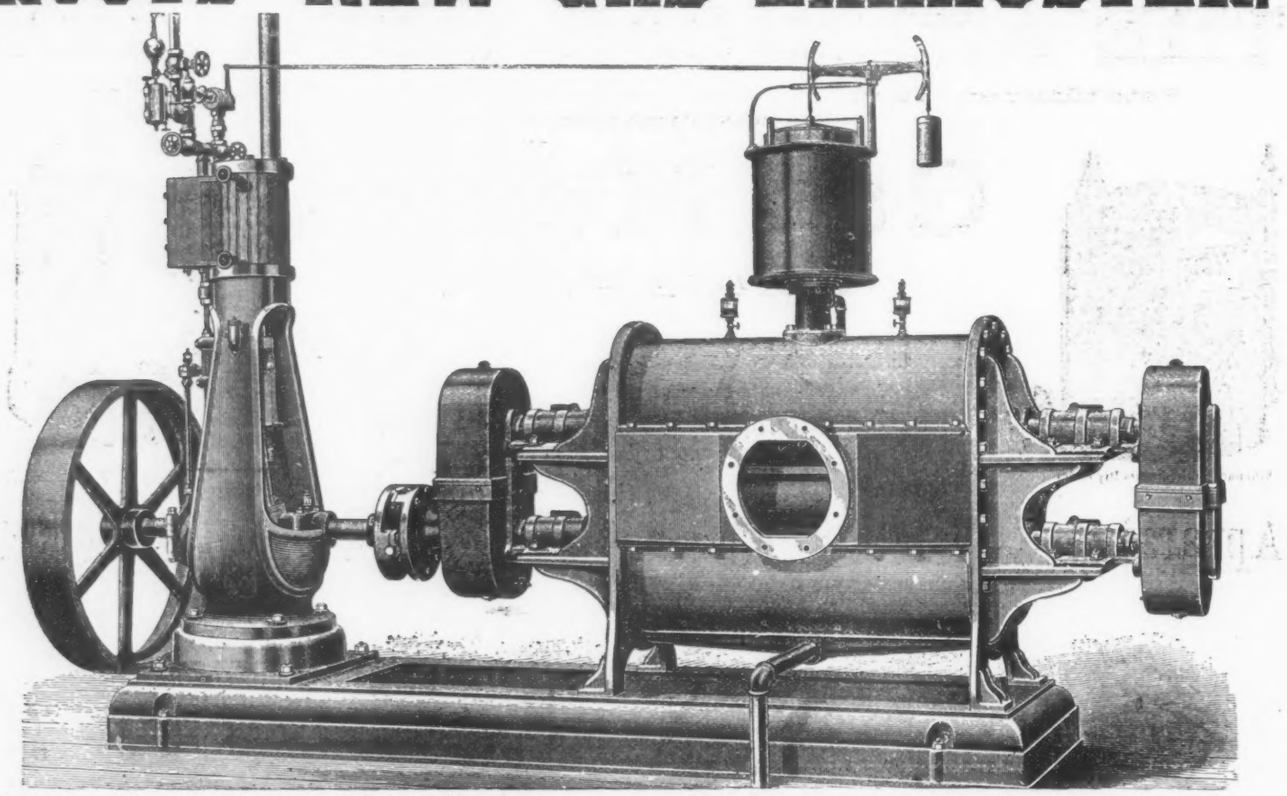
AGENCIES,

No. 177 Elm Street, Cincinnati, Ohio. No. 222 Sutter Street, San Francisco, Cal.

No. 810 North Second Street, St. Louis, Mo.

GAS STOVE SHOW ROOMS, No. 242 Sixth Avenue, New York City.

ROOTS' NEW GAS EXHAUSTER.



THE P. H. & F. M. ROOTS CO., Patentees and Manufacturers, CONNERSVILLE, IND.

S. S. TOWNSEND, Gen. Agt., 22 Cortlandt St., N. Y. COOKE & CO., Selling Agts., 22 Cortlandt St., N. Y.

SCIENTIFIC BOOKS.

We are prepared to furnish to Gas Managers, and others interested in the topics treated of, the following books, at prices named:

KING'S TREATISE ON THE MANUFACTURE OF COAL GAS. Three vols; $10 per vol.

GAS MANUFACTURE, by WILLIAM RICHARDS. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

TECHNICAL GAS ANALYSIS. $3.00.

GAS CONSUMER'S GUIDE. $1.

A GUIDE TO GAS LIGHTING. 40 cents.

GAS MEASUREMENT AND GAS METER TESTING, by F. W. HARTLEY. $1.00.

GAS CONSUMER'S HANDBOOK, by WILLIAM RICHARDS, C.E.; 18mo., Sewed. 20 cents.

A PRACTICAL TREATISE ON GAS AND VENTILATION, with Special Relation to Illuminating, Heating, and Cooking by Gas, by E. E. PERKINS. $1.25.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

GAS WORKS—THEIR ARRANGEMENT, CONSTRUCTION, PLANT, AND MACHINERY. $8.

COAL; ITS HISTORY AND USE, by PROF. THORPE. $1.50.

THE GAS WORKS OF LONDON, by COLBURN. 60 cents.

THE GAS FITTER'S GUIDE, Showing the Principles and Practice of Lighting with Coal Gas, by JOHN ELDRIDGE. 40 cents.

MUNICIPAL LIGHTING, by F. H. WHIPPLE. $1.

GAS WORKS, AND MANUFACTURING COAL GAS, HUGHES. $2.20.

THE MANAGEMENT OF SMALL GAS WORKS, by C. J. R. HUMPHREYS. $1.

MANUAL FOR GAS ENGINEERING STUDENTS, by D. LEE. 40 cents.

HOW TO MANAGE GAS, by F. WILKINS. Paper. 20 cents.

THE DOMESTIC USES OF COAL GAS, AS APPLIED TO LIGHTING, by W. SUGG. $1.40.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR, by GEO. LUNGE. New Edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS, by D. A. GRAHAM. 8vo, Cloth. $3.

GAS COMPANIES DIRECTORY. $3.

GAS VERSUS ELECTRIC LIGHT. 50 cents.

THE AMERICAN GAS ENGINEER AND SUPERINTENDENT'S HANDBOOK, by WM. MOONEY. $3.

DIGEST OF GAS LAW. $3.

GAS ENGINE INDICATOR DIAGRAM, by W. E. AYRTON. Paper. 20 cents.

ILLUMINATING AND HEATING GAS, by W. BURNS. $1.50.

TESTING PIPES AND PIPE JOINTS, by M. M. PATERSON. 80 cents.

DESIGNING WROUGHT AND CAST IRON WORK, by H. ADAMS. Paper. Three parts, 60 cents each.

NOTES IN MECHANICAL ENGINEERING, by H. ADAMS. $1.

STRAINS IN IRONWORK, by H. ADAMS. With plates. $1.75.

ELECTRICITY.

THE ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage, and Distribution, by PHILIP ATKINSON. $1.50.

ELEMENTARY ELECTRICITY, by PROF. F. JENKIN. 40 cts.

ELECTRIC TRANSMISSION OF ENERGY, by G. KNAPP. $3.

ARC AND GLOW LAMPS, by J. MAIER. Illustrated. $3.

ELECTRICIAN'S POCKET-BOOK, by MONROE and JAMIESON. $2.50.

MAGNETISM AND ELECTRICITY, by J. OVEREND. 40 cents.

ACCUMULATORS, by SIR D. SALOMONS. $1.20.

DYNAMO BUILDING, by F. W. WALKER. 80 cents.

ELECTRICAL TABLES AND FORMULÆ, by L. CLARK and R. SABINE. $5.

ELECTRIC LIGHTING FROM CENTRAL STATIONS, by G. FORBES. Paper. 40 cents.

ELECTRIC LIGHT PRECAUTIONS, by K. HEDGES. Illustrated. $1.

SUPPLY OF ELECTRICITY BY LOCAL AUTHORITIES, by K. HEDGES. Paper. 40 cents.

DOMESTIC ELECTRICITY FOR AMATEURS, by E. HOSPITALIER. $3.

The above will be forwarded by express, upon receipt of price. If sent by mail, postage must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order.

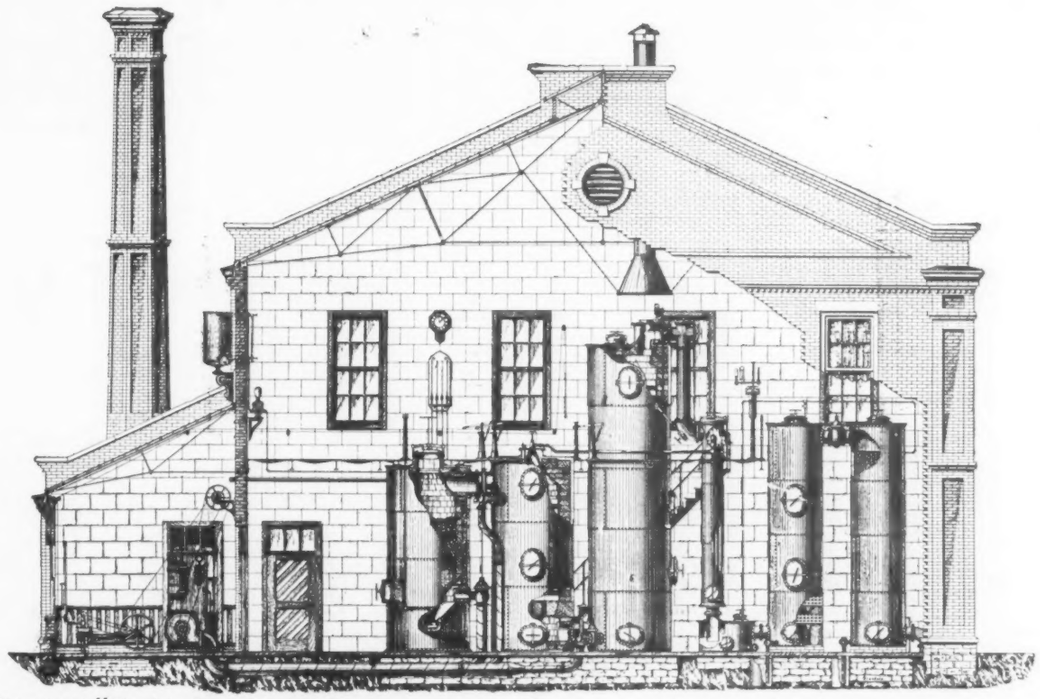
A. M. CALLENDER & CO., 42 Pine Street, New York.

THE UNITED GAS IMPROVEMENT CO.,

DREXEL BUILDING, PHILA., PA.

Owners of the Lowe, Granger-Collins, McKay-Critchlow (for carbureting Natural Gas), and Other Gas Patents.

BUILDERS, LESSEES and PURCHASERS OF GAS WORKS.



Standard "Double Superheater" Lowe Apparatus, Especially Designed for the Use of Lima Crude Oil.

Erectors of

WATER GAS PLANTS,

(Either Independent or Auxiliary to Coal Gas Works),

USING LIMA OR OTHER LOW GRADE OILS AND ANTHRACITE COAL OR GAS HOUSE OR OVEN COKE.

PAMPHLETS, PLANS, AND ESTIMATES FURNISHED UPON APPLICATION.

NATIONAL GAS LIGHT AND FUEL CO.,

218 La Salle Street, Chicago.

C. D. HAUK, Prest. & Gen'l Manager. A. W. GREEN, Vice-Prest. N. A. McCLARY, Sec. & Treas. E. E. MORRELL, Engr.

GAS WORKS

Built, Remodeled, Leased, and Purchased.

71 Springer Cupolas have been installed in the U. S. during the past four years.

The total capacity of Springer Apparatus now in use is over 25,000,000 ft. daily.

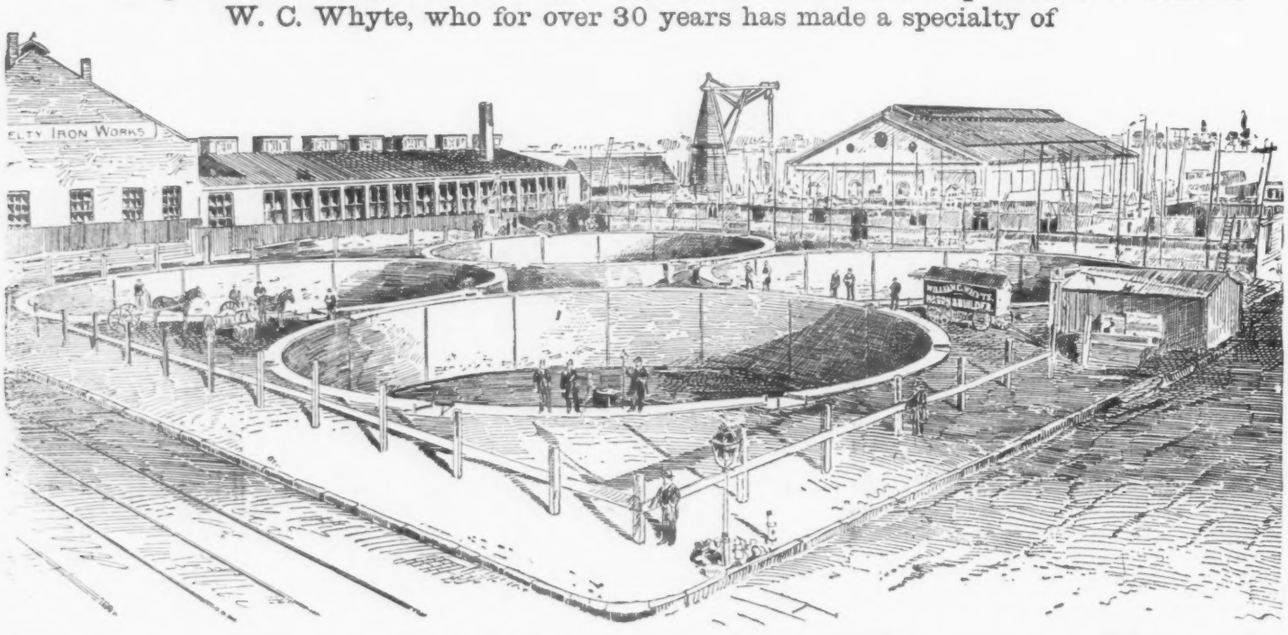
THE SPRINGER CUPOLA SYSTEM

Has Proven Itself the most Economical and Satisfactory Method of Gas Manufacture ever brought to the attention of the Gas Fraternity.

GUARANTEED ESTIMATES of Cost of Gas Furnished on Application.

GASHOLDER TANK CONSTRUCTION, ETC.

Gas Companies and others about to erect Gasholders will find it profitable to consult W. C. Whyte, who for over 30 years has made a specialty of



Tank Excavation and Mason Work.

Fifty Tanks now in operation show the sort of work done. Address

W. C. WHYTE, - No. 15 Cortlandt Street, N. Y. City.

CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)

MANUFACTURERS OF GAS WORKS SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying agent ever offered as a substitute for lime. Now used *in every State in the Union*, and purifying daily over *thirty-five million cubic feet.* Should be used in every gas works. Its own saving will pay for it many times over.

AUTOMATIC GOVERNOR. Has been on the market but *three years*, and in that time has been introduced *more generally* than any invention ever designed for use in gas works. Over *three hundred* of them now in use. Sensitive; reliable; perfectly automatic; reduces leakage; satisfies consumers, and gives great relief to the Manager. No gas works is *complete* without one of these machines.

STEAM JET EXHAUSTER. Designed particularly for small works Combines Exhaust Tube, Steam Governor Gas Compensator, and Bye-Pass Valves in the most compact form possible; occupies but little space; uses very little steam; operated by ordinary workmen; saves formation of carbon in retorts; increases yield 10 to 15 per cent. Specially adapted for *mixing air* with oil gas. *No works* too small to use them profitably.

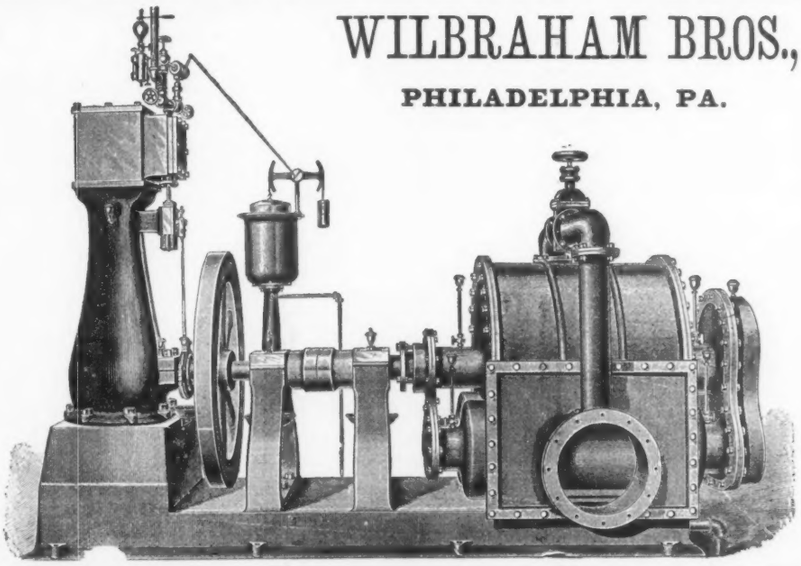
Prices given on all our specialties *delivered at any point in the United States.* Correspondence solicited.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 111 Broadway, New York.

WILBRAHAM
GAS EXHAUSTER & ENGINE COMBINED.

WILBRAHAM BROS.,

PHILADELPHIA, PA.



JARVIS ENGINEERING CO.,

61 Oliver St., Boston, Mass.

CONTRACTORS FOR ERECTING

COMPLETE STEAM OUTFITS FOR ELECTRIC LIGHTING STATIONS.

Steel Boilers set with Jarvis Pat. Boiler Setting

To burn **COKE SCREENINGS** for Fuel.

ARMINGTON & SIMS CO. ENGINES,

Belting direct to Dynamos, without using Shafting.

SEND FOR CIRCULARS.

REFERENCES.—Charlestown Gas & Electric Light Co., Charlestown, Mass.; Schenectady Gas & Electric Light Co., Schenectady N. Y.; Brookline Gas Co., Brookline, Mass.

Practical Electric Lighting.

By A. BROMLEY HOLMES, A.M.I.C.E.

With 87 Illustrations. Third Edition. **Price, $1.00.**

Electric Light Primer.

By CHARLES L. LEVEY.

A simple and comprehensive Digest of all the most important facts connected with the running of the Dynamo and Electric Lights, with Precautions for Safety, etc.

Price, 50 cents.

A. M. CALLENDER & CO., 42 Pine St., N.Y.

Gasholder Tanks & Gas Works Masonry Complete.

PLANS PREPARED AND ESTIMATES FURNISHED AT SHORT NOTICE.

J. P. WHITTIER, 70 Rush St., near Division Av., Brooklyn, N. Y.

A Large Quantity of Ground Fire Brick For Sale Cheap.

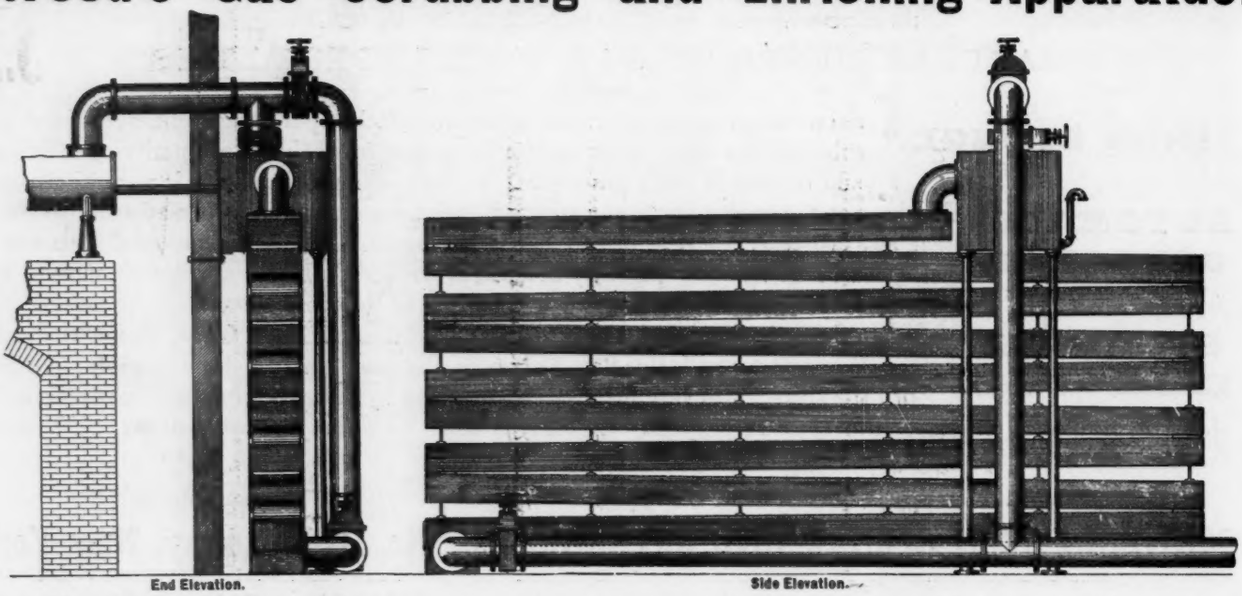
1890 DIRECTORY 1890

OF THE GAS LIGHT COMPANIES of the UNITED STATES & CANADA

Price, - - - - - - - $5.00.

A. M. CALLENDER & CO., No. 42 Pine Street, N. Y. City.

Wood's Gas Scrubbing and Enriching Apparatus.



End Elevation. Side Elevation.

The cheapest, simplest, and most effective apparatus for removing Tar and Ammonia, and enriching Gas, ever brought to the attention of Gas Manufacturers. With ordinary condensers and scrubbers the condensable illuminants flow off to the tar wells and liquor tanks and are lost, but with Wood's Apparatus these illuminants are saved and retained in the gas, thus increasing its illuminating power and making a great saving in the cost of enriching material. Where set up next after the Hydraulic main, this Scrubber produces an 8-oz. Ammoniacal Liquor.

JAMES R. FLOYD & SONS, - - Nos. 531 to 543 West 20th Street, N. Y. City.

FORT WAYNE ELECTRIC CO.

FORT WAYNE, IND.

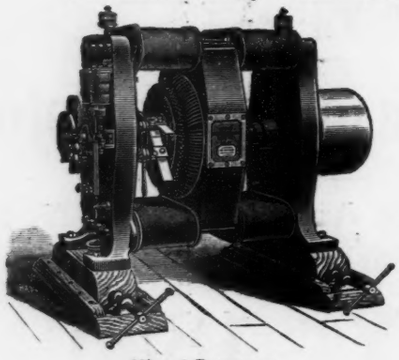
MANUFACTURERS OF THE

Slattery Induction System

—OF—

LONG DISTANCE INCANDESCENT LIGHTING.

The Most Carefully Worked Out and Complete Alternating Current System of Electric Lighting in Existence.



Wood Dynamo.

—AND THE—

WOOD

Automatically Regulating

ARC DYNAMOS and LAMPS.

Main Office, - - - - Fort Wayne, Indiana.

Factories: Fort Wayne, Ind.; Brooklyn, N. Y.

BRANCH OFFICES.

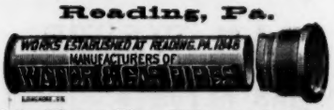
NEW YORK, - - - - - - 115 Broadway.	DETROIT, MICH., - - - 57 Gratiot Avenue.
PHILADELPHIA, - - - - - 907 Filbert Street.	TORONTO, CANADA, - - 138 King Street, West.
CHICAGO, - - - 185 Dearborn Street.	MEXICO, F. Adams' Successors, - - City of Mexico.
SAN FRANCISCO, - - 35 New Montgomery Street.	CUBA, Maicas & Co., - - - - - Havana.

ENGINEERS. GAS AND WATER PIPES. GAS AND WATER PIPES.

P. D. WANNER, Chairman. A. H. MELLERT, Mangr. of Wks.
R. B. KINSEY, Secretary. F. A. KNOPP, Treasurer.

MELLERT FOUNDRY & MACHINE CO. Ltd. and READING FOUNDRY CO., Ltd.

Reading, Pa.



Specials—Flange Pipe, Valves and Hydrants Lamp Posts, Retorts, etc.

General Foundry and Machine Work.

JOHN FOX, Selling Agent. **160 Broadway, N.Y.**

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS.

Columbus, Ohio.

M. J. DRUMMOND,

SPECIAL CASTINGS AND LAMP POSTS.

Office, Corbin Building, 192 Broadway, N. Y.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

JOS. R. THOMAS,

No. 42 Pine Street, N.Y. City.

CONSULTING AND CONSTRUCTING

Gas Engineer and Contractor.

PLANS, SPECIFICATIONS, AND ESTIMATES FURNISHED.

Contracts taken for all Appliances required at a Gas Works,

Either for New Works or Extensions to Old Plants.

WM. MOONEY

(Successor to WM. FARMER)

No. 94 Liberty St., N Y. City.

GAS ENGINEER AND CONTRACTOR FOR THE ERECTION OF GAS WORKS, OR APPARATUS OF ANY CAPACITY.

Plans and Specifications Furnished.

SAM'L R. SHIPLEY, Pres. JAS. P. MICHELLON, Sec.
HENRY B. CHEW, Tr WM. SEXTON, Supt.

GLOUCESTER IRON WORKS,

GLOUCESTER CITY, N. J.

Cast Iron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gasholders, &c.

Office, Rooms 703 & 704, Provident Bldg., 401 Chestnut St., Phila., Pa.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

DENNIS LONG & COMPANY,

LOUISVILLE, KY.,

Manufacture Exclusively

CAST IRON GAS & WATER PIPE & SPECIAL CASTINGS

OF ALL SIZES.

SPIRAL WELD STEEL PRESSURE TUBES.

HAMMER WELDED.

Best Gas Pipe Made

Strong, Light, Cheap

Flanges, Hubs & Spigots to the Regular Standards. Couplings for all Uses.

THE SPIRAL WELD TUBE COMPANY, - 43 JOHN STREET, N. Y.

King's Treatise on Coal Gas.

In 3 Vols. Price per Vol., $10. Sold either by Volume or in Sets.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

RETORTS AND FIRE BRICK.

J. H. GAUTIER & CO.,

CORNER OF

GREENE AND ESSEX STREETS,

JERSEY CITY, N. J.

MANUFACTURERS OF

Clay Gas Retorts,

Gas House Tiles,

Fire Bricks, Etc. Etc.

Ground Clay, Fire Brick and Fire Sand in Barrels,

J. H. GAUTIER. C. E. GREGORY. C. E. GAUTIER.

BROOKLYN

Clay Retort & Fire Brick Works,

(EDWARD D. WHITE & CO.)

Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.

VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.

Office, 88 Van Dyke St., Brooklyn, N. Y.

RETORTS AND FIRE BRICK.

LACLEDE FIRE BRICK MFG. CO.,

MANUFACTURERS OF

Fire Brick, Gas Retorts,

AND

ST. LOUIS STANDARD SEWER PIPE.

Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.

OFFICE AND DEPOT

901, 903, and 905 Pine Street,

ST. LOUIS, MO.

ESTABLISHED IN 1845.

B. KREISCHER & SONS,

OFFICE FOOT OF HOUSTON ST., E.R., N.Y.

Gas Retorts,

TILES, FIRE BRICK.

AND EVERYTHING IN THE FIRE CLAY LINE.

RETORTS AND FIRE BRICK.

MANHATTAN

FIRE BRICK & ENAMELLED CLAY

RETORT WORKS

ADAM WEBER.

CLAY GAS RETORTS

AND RETORT SETTINGS

FIRE BRICKS, TILES, ETC.,

Office and Works, 15th Street and Avenue C., N. Y

Works, LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Successor to WILLIAM GARDNER & SON.

Office, Rooms 19 & 20, Lewis Block PITTSBURGH, PA. P. O. Box 373

Fire Clay Goods for Gas Works.

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

H. A. NORTON, No. 92 WATER STREET, BOSTON, MASS., Agent for the New England States.

GEO. C. HICKS, Prest. **CHICAGO** CHAS. A. REED, Sec. & Treas.

Retort and Fire Brick Co.,

MANUFACTURERS OF

Fire Clay Goods of all Kinds,

AND BEST QUALITY ONLY.

Regenerative Furnaces & Water Gas Goods.

45th St., Clark to La Salle, Chicago.

GEROULD'S IMPROVED RETORT CEMENT

A Cement for patching retorts, putting on mouthpieces, and making up all bench-work joints. This Cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick. For recommendations and price list address

C. L. GEROULD & CO.

5 & 7 Skillman St., Brooklyn, N. Y.

Western Agent, H. T. GEROULD, Mendota, Ill.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,

Mermod-Jaccard Bldg., Rooms 307 & 308, Broadway & Locust St., St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We have the *exclusive Agency for the West* of the celebrated

Kloenne-Bredel Full Depth and Semi-Recuperator Benches,

And also furnish and build

Our Own Styles Semi-Recuperator Furnaces for the use of Coal or Coke as fuel.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Supt

BALTIMORE

RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY,

AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.

WALDO BROS., 88 WATER ST., BOSTON, MASS

Sole Agents the New England States.

Boston Fire Brick Works Manufacturers of **Gas Retorts and Settings**

Under the Personal Supervision of MR. GEO. C. HICKS late of Chicago.

Fire Clay Goods of all kinds. Akron Sewer Pipe, Lime, Cement, etc. Agts. for the Arc Gas Lamp & Governing Gas Burners.

Send for Circulars and Prices to

FISKE, COLEMAN & CO., Managers, No. 62 Congress Street, Boston, Mass.

FRED. BREDEL, C. E.,

Contractor for the Complete Erection and Equipment of Gas Works.

Sole Proprietor of the KLOENNE PATENTS for North America.

Gas Condensing and Purifying Machine.

Doing all the Work Between Exhauster & Oxide Purifier.

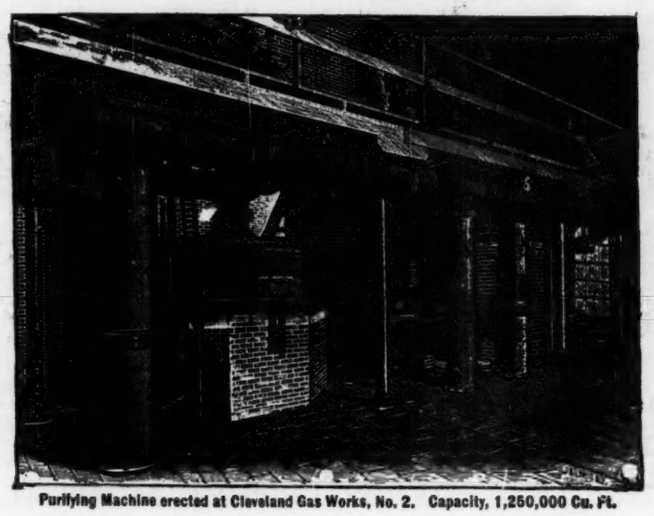
No Condensers Required.

No Naphthaline or Pitch is Formed.

HIGHER CANDLE POWER.

Tar & Ammonia Washers

WATER GAS WASHERS.



Purifying Machine erected at Cleveland Gas Works, No. 2. Capacity, 1,250,000 Cu. Ft.

RECUPERATIVE FURNACES.

Adapted to Retort Houses With or Without Stage Level.

Over 1,400 Retorts Now in Use in America.

Inclined Retort Benches.

Refers, by permission, to Mr. Eugene Vanderpool, Newark, N. J., and Mr. E. G. Cowdery, Milwaukee, Wis.

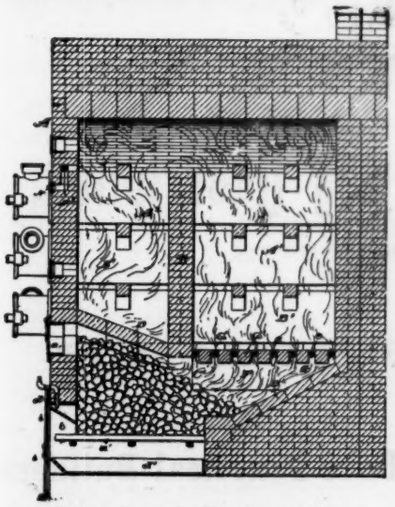
For further information address

FRED. BREDEL,

No. 208 East Seventeenth Street, - - - - New York City.

FLEMMING'S

Generator-Gas Furnace



Materials furnished and Benches erected by

J. H. GAUTIER & CO., - Jersey City, N. J.

Address as above, or D. D. FLEMMING, Jersey City, N. J.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.

OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

THE NEW HANDY BINDER.

This article may be described as elegant in appearance, strong, durable, and possessing many special qualities of its own. It allows the opening of the pages perfectly flat, whether one or several numbers are in the binder Any number can be taken out and replaced without disturbing he others. The papers are not mutilated for subsequent binding in permanent form. The binder is supplied with gilt side title, and is an ornament to any desk or reading table. The JOURNAL, filed in the Handy Binder, becomes a volume of great alue, always convenient for instant reference. Handy Binder, Postage paid, $1 00.

A. M. CALLENDER & CO., 42 PINE STREET, NEW YORK CITY.

The American Gas Engineer and Superintendent's Handbook.

By WILLIAM MOONEY.

Consisting of Rules, Reference Tables, and Original Matter Pertaining to the Manufacture, Manipulation, and Distribution of Illuminating Gas.

350 Pages, Full Gilt Morocco. Price, $3.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS.

The present (the fifth) edition marks an important advance on those that have gone before. Considerable additions have been made to the text, and much of it has been rewritten and otherwise improved. Price, cloth, $6.

A. M. CALLENDER & CO., 42 Pine St. N. Y.

DAVIS & FARNUM MFG. CO.,

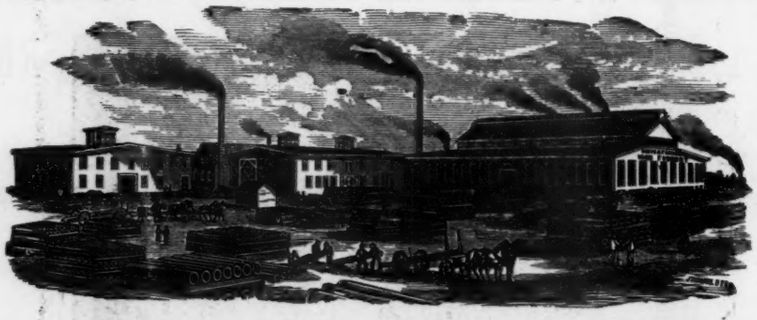
WALTHAM, MASS.

PRINCIPAL OFFICE AND WORKS, Waltham, Mass. BOSTON OFFICE, Room 55, Mason Building, 70 Kilby Street.

SINGLE, DOUBLE, AND TRIPLE LIFT

Gasholders.

OF ANY CAPACITY.



TUBULAR, PIPE, AND SINUOUS FRICTION

Condensers.

OF ALL SIZES.

IRON ROOF FRAMES AND FLOORS.

Purifying Boxes, Center Seal or Valve Connections, Bench Work.

Reversible Lime Trays.

SELF-SEALING AND PRESSED STEEL MOUTHPIECE LIDS.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Plant

—ALSO—

Gas and Water Pipe, Flanged Pipe,

Sugar House Work, and Special Castings of all Descriptions.

Established 1861. Incorporated 1881.

KERR MURRAY MFG. CO.,

FORT WAYNE, IND.

Those who are in need of

Holders or Gas Works Apparatus of any Description,

AND OF THE LATEST IMPROVEMENTS,

will find it to their interest to

GET AN ESTIMATE FROM US

before placing their order.

As we make a Specialty of this Class of Work, and are Practical Builders and Manufacturers of same,

with our long years of experience in the business,

WE CAN GUARANTEE YOU SATISFACTION.

Estimates, Plans and Specifications Furnished on Application.

BARTLETT, HAYWARD & CO.

Baltimore, Md.

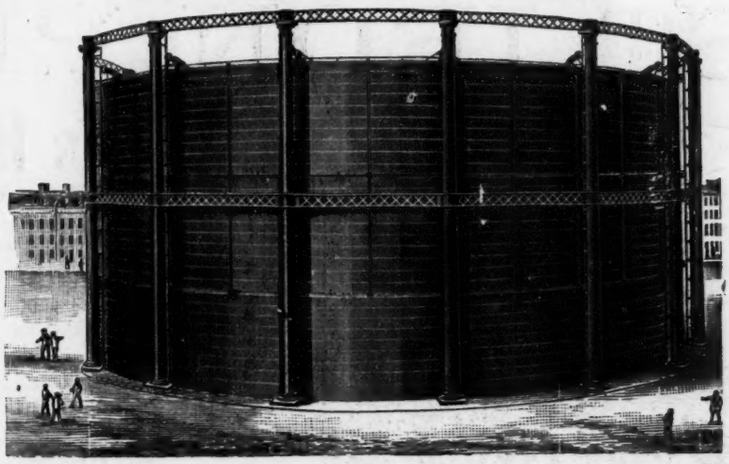
Triple Double, & Single-Lift
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS.



PURIFIERS.

CONDENSERS.

Scrubbers.

BENCH CASTINGS.

OIL STORAGE TANKS.

Boilers.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

Munich Regenerative Furnace, System Drs. Schilling & Bunte.

MILL'S REVERSIBEL LIME TRAYS.

Gas Works Designed and Constructed.

Pascal Iron Works. ESTABLISHED —1821.— Delaware Iron Works.

MORRIS, TASKER & CO.,

INCORPORATED.

OFFICE, 224 SOUTH THIRD STREET, - - PHILADELPHIA, PA.

CONTRACTORS, BUILDERS, AND MANUFACTURERS OF

Gas, Water & Sugar Works

Bench Castings.

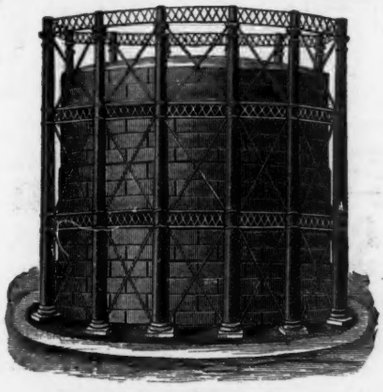
Condensers.

Scrubbers.

Purifiers.

Hyd. Carriages.

Iron Floors,



Iron Roofs.

Street Stops,

Valves, etc.

Stand-Pipes.

Water & Oil

Tanks, all Sizes.

Single, Double, and Triple-Lift Gas Holders.

SELF-SEALING RETORT LIDS. STAMPED STEEL RETORT LIDS.

Locomotive Water Columns, Filters, etc. Boiler Tubes, Wrought Iron Pipe & Fittings

Plans, Specifications and Estimates for all kinds of Machinery furnished on application.

Foundries & Works, MILLVILLE, FLORENCE, and CAMDEN, N. J.

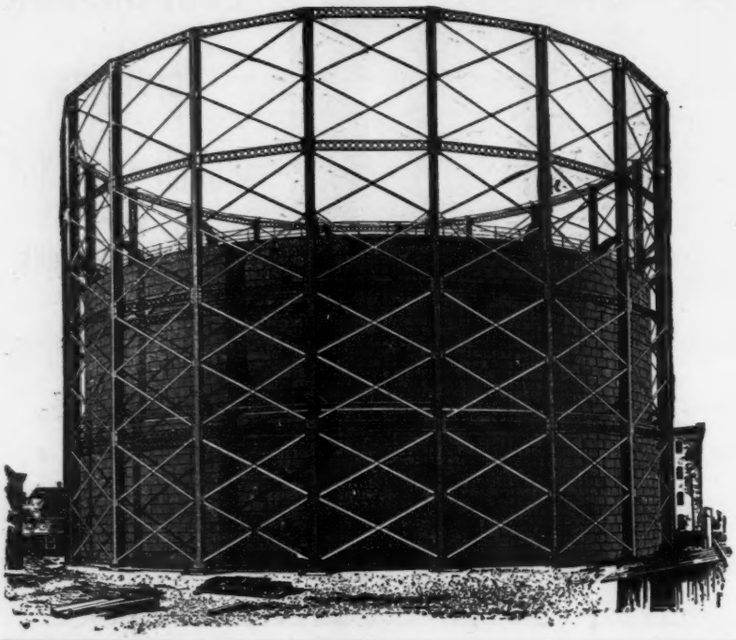
R. D. WOOD & CO.,

Engineers, Iron Founders, and Machinists.

400 Chestnut St., PHILADELPHIA, PA.

MANUFACTURERS OF

CAST IRON PIPE,



Gas Holders,

SINGLE, DOUBLE, AND TRIPLE LIFTS, WITH OR WITHOUT WROUGHT IRON OR STEEL TANKS.

PURIFIERS, CONDENSERS.

Scrubbers.

BENCH WORK.

Iron Floors and Roofs, Plate Girders.

Heavy Loam Castings.

HYDRAULIC WORK.

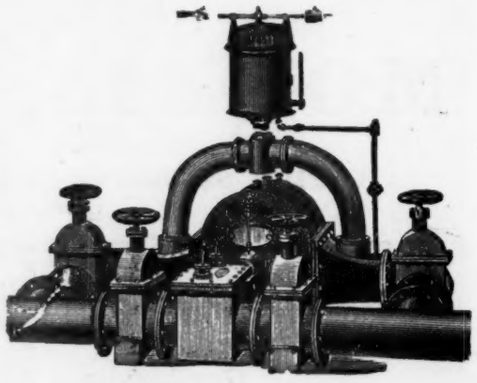
Lamp Posts, Valves, Etc.

ISBELL-PORTER COMPANY,

(Successors to SMITH & SAYRE MFG. COMPANY)

G. G. PORTER, Prest. *245 Broadway, N. Y.* CHAS. W. ISBELL, Sec'y.

Machinery & Apparatus for Gas Works



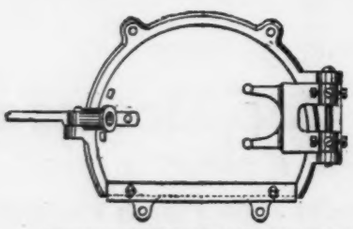
Drawings, Plans, and Estimates Furnished for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

Mackenzie's Patent Rotary and Steam Jet Gas Exhausters, Governors, Compensators, Condensers, Washers, Scrubbers. Isbell's Patent Automatic Street Pressure Governor, Gas and Water Valves, Hydraulic Main Dip Regulator, Bench Castings, etc. Purifying Boxes and "Standard" Scrubbers Isbell's Patent Self-Sealing Retort Doors

THE BRENNER SELF-SEALING RETORT DOOR.

Simple, Strong, and Durable.

CLOSES ABSOLUTELY TIGHT & IS LOCKED BY A CAM LEVER. ALL NECESSARY ADJUSTMENT FOR WEAR PROVIDED.



Brenner Self-Sealing Retort Door.

BUILT BY

ISBELL-PORTER COMPANY,

(Successors to Smith & Sayre Mfg. Co.)

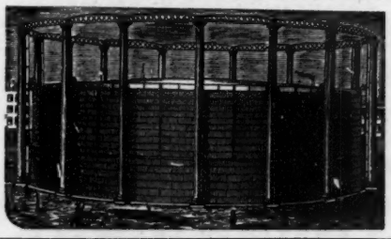
No. 245 Broadway, - - - - New York City.

WILLIAM B. LUNDIE, Superintendent of the 42d Street Station of the Consolidated Gas Company, of New York, writes, under date of Jan. 4, 1889:

"We have 320 Brenner Self-Sealing Lids in use at this Station, built by the Smith & Sayre Mfg. Co. They require very little attention, and are the best of the kind that I have seen, giving entire satisfaction."

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

JAMES R. FLOYD & SONS,
(SUCCESSORS TO HERRING & FLOYD)
Oregon Iron Works,
W. 20th & 21st. Sts., bet. 10th & 11th Avs.,
NEW YORK CITY.
Engineers and Contractors
FOR THE
CONSTRUCTION OF GAS WORKS.
MANUFACTURERS OF
All Kinds of Castings and General Ironwork
FOR
GAS APPARATUS.
Bench Castings, Regenerative and Half Regenerative Furnace Castings.
Condensers, Scrubbers, Purifiers, Street Drips and Connections,
Valves,
Hydraulic Hoisting Purifier Carriage, Self-Sealing Retort Lids, Improved Valve Stand and Indicator, Seller's Cement.
Plans, Specifications, and Estimates furnished for Construction of New or Alteration of Old Works.

CONTINENTAL IRON WORKS.
THOS. F. ROWLAND, Prest. WARREN E. HILL and CHAS. H. CORBETT, V-Prests. THOS. F. ROWLAND, JR., Sec. & Treas.
P. O. Station G., BROOKLYN, N. Y.

ENGINEERS AND MANUFACTURERS OF
Gas Holders
CONDENSERS, SCRUBBERS, VALVES,
PURIFIERS, SELF-SEALING RETORT LIDS,
Hydraulic Mains,
And all other articles connected with the manufacture and distribution of Gas.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Prest. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.
STACEY MFG. CO.,
MANUFACTURERS OF
Single and Telescopic Gasholders,
IRON ROOFS, BRIDGES, LAMP POSTS,
Water and Oil Tanks, Coal Elevator Cars,
COKE CRUSHERS, BENCH CASTINGS,
And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works. Rolling Mill Machinery and Heavy Castings a Specialty.
Foundry: 33, 35, 37 & 39 Mill Street. Wrought Iron Works: 16, 18, 20, 22, 24 & 26 Ramsey Street:
Cincinnati, Ohio.

Bouton Foundry Co.,
FOUNDERS AND MACHINISTS,
CHICAGO, ILL.
Gas Works Apparatus,
PURIFIERS, CONDENSERS,
Bench Work
SPECIALS, LAMP POSTS,
SCRUBBERS,
Iron Roofs and Floors.
Plans and Estimates furnished for new works or extensions of old works.

1842. **DEILY & FOWLER,** 1891.
Laurel Iron Works.
Address, No. 39 Laurel Street, Philadelphia, Pa.
BUILDERS OF
GASHOLDERS,
Single and Telescopic.
Holders Built 1885 to 1890, Inclusive:

Omaha, Neb.	Port Chester, N. Y.	Paducah, Ky.	Tacony, Pa. (two)	Central Gas Lt. Co., New York City (2d)
Scranton, Pa. (2d)	New Rochelle, N. Y.	Norwich, Conn.	Mount Vernon, N. Y.	Tacoma, Wash.
Long Island City, N. Y.	Salem, N. J. (3d)	Seattle, W. T.	Binghamton, N. Y.	Knoxville, Tenn.
Macon, Ga.	Omaha, Neb. (2d)	San Diego, Cal.	Concord, N. H.	Pottstown, Pa.
York, Pa.	Lynn, Mass. (2d)	Northern Gas Lt. Co., of New York, N. Y.	Dover, Del. (2d)	Victoria, B. C.
Chester, Pa.	Little Rock, Ark.	Westerly, R. I.	Calais, Me.	Vancouver, B. C.
Hazleton, Pa. (2d.)	Irvington, N. Y.	Willimantic, Conn	New London, Conn. (2d)	Charlottesville, Va.
Staten Island, N. Y.	South Boston, Mass.	Montclair, N. J.	West Chester, N. Y.	So. Framingham, Mass.
Saugerties, N. Y.	Rye, N. Y. (2)	Attleboro, Mass.	Bay Shore, L. I.	Woonsocket, R. I.
Clinton, Mass. (Lan. Mills)	Woodstock, Ont.	Santa Cruz, Cal.	Washington, D. C.	Simcoe, Can.
Chattanooga, Tenn.	Malden, Mass.	Erie, Pa. (2d)	Newport, R. I. (2d)	Pittsfield, Mass. (2d)
Galveston, Texas. (3d.)	Staten Island, N. Y. (2d)	West Chester, Pa. (2d	Morristown, N. J.	Chattanooga, Tenn. (2d)
Fort Plain, N. Y.	Woodstock, Ont.	Lancaster, Pa. (3d	Lebanon, Pa.	
Brunswick, Ga.	Malden, Mass.		Oakland, Cal.	

WM. HENRY WHITE,
No. 32 Pine Street, - - - New York City.
ENGINEER AND CONTRACTOR FOR THE
ERECTION AND EXTENSION OF
GAS, WATER, AND ELECTRIC LIGHT WORKS.
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.
Plans and Estimates Furnished.

GAS COALS. CANNEL COALS. GAS ENRICHERS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 & 229 Produce Exchange, New York.

Cable Address, "PERKINS, NEW YORK." Post Office Box 3695, New York.

GENERAL SALES AGENTS FOR

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS-COAL.

HON. W. L. SCOTT, Prest. M. H. TAYLOR, Vice-Prest.

This Colliery is located at SCOTT HAVEN, PA., in the center of the Youghiogheny Gas Coal District, and produces the ONLY RELIABLE YOUGHIOGHENY COAL for gas purposes. (See Map on p. 87 of this JOURNAL, Feb. 16, '85.)

POINTS OF SHIPMENT,

Locust Point, BALTIMORE. Pier No. 62, PHILADELPHIA.

Also, SOLE AGENTS for the

BRECKENRIDGE CANNEL,

OF KENTUCKY.

Within the past two years we have delivered this Cannel to over ONE HUNDRED COMPANIES IN THIRTY-THREE DIFFERENT STATES, and it is now in use in some of the large Gas Works

On the Continent and in South America,

where it successfully competes with the Australian Shale. It is the ONLY AMERICAN GAS CANNEL of sufficiently high grade to warrant EXPORTATION TO EUROPE AND SOUTH AMERICA, and it is the only economical substitute for OIL OR NAPHTHA. ONE GROSS TON will produce

10,000 Cubic Feet of 75 Candle Gas,
or 12,500 " " 60 " "
or 15,000 " " 50 " "
} equal to { 750,000 Candle Feet of Gas, and 26 Bushels of merchantable Coke weighing 900 Pounds

This is the ONLY GAS CANNEL that will produce a REALLY MERCHANTABLE COKE. It can be delivered in parcels of one carload or more to any point in the United States or Canada. Cargo shipments of any size required can be made from NEW YORK, PHILADELPHIA, BALTIMORE, or NEWPORT NEWS. Samples will be sent and particulars of price, etc., forwarded upon application to above address.

JAMES & WILLIAM WOOD,

Gas and Cannel Coal Contractors,

No. 40 St. Enoch Sq., Glasgow. No. 2 Talbot Court, London.

Proprietors of the BATHVILLE COLLIERIES (which produce the celebrated BOGHEAD CANNEL), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

STANDARD CANNELS,

Unequaled as Gas Enrichers.

Analyses, prices, and all further information furnished on application to

Agency for U.S., Room 70, Nos. 2 & 4 Stone St., N.Y. City.

The Standard Oil Company,

REFINERS OF

NAPTHA AND GASOLINES.

ALSO MANUFACTURERS OF

A Special Grade of Naptha for Gas Companies

FOR ENRICHING COAL GAS.

Correspondence solicited.

No. 43 Euclid Avenue, Cleveland, Ohio.

To Gas Companies.

We make to order CAP BURNERS to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

248 N 8th Street, Phila. Pa.

COKE CRUSHERS.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

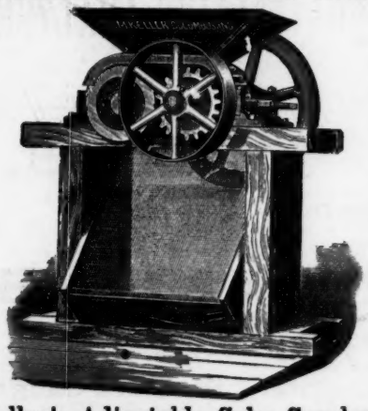
DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, Clarksburg, Harrison Co., W. Va.
WHARVES, Locust Point, Baltimore, Md.
OFFICE, 44 South Street, Baltimore, Md

ROUSSEL & HICKS, 71 Broadway, N. Y. } *AGENTS.* { BANGS & HORTON, 60 Congress St., Boston



Keller's Adjustable Coke Crusher.

SIMPLE, STRONG, AND DURABLE.

C. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. **Columbus, Ind.**

Correspondence Solicited.

GASOLINE and GAS ENGINES

Our new Engines are hustlers. A 6 x 7 inch Engine, now running 100 feet of shafting. Boring Mills, Planers, Lathes, Drill Presses and Milling Machines for 20 Machinists, on 6 gal. Gasoline per day, costing only 60 cts. Write for information. *Mention this paper.*

Van Duzen Gas & Gasoline Engine Co.
CINCINNATI, OHIO.

A. MacKinnon Machine Co., Agts., 22 Warren St., N.Y.

King's Treatise on Coal Gas.

The most complete work on Coal Gas ever published.

Three Vols. Bound, $30.

GAS COALS. GAS COALS.

THE PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened & Prepared for Gas Purposes.

Their Property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

209 SOUTH THIRD STREET, PHILA., PA.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS,

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

C. B. ORCUTT, General Agent, - - No. 1 Broadway (Room 217) New York City

FRANCIS H. JACKSON, Prest. EDMUND H. MCCULLOUGH, V.-Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

THE CLERK GAS ENGINE CO.,

Main Office, 1012, 1014, 1016, 1018 Filbert St., Philadelphia, Pa.

WM. W. GOODWIN, Prest. **E. STEIN, Sec.**

The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in running, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York, in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time

Made in Sizes of 5, 10, 15, 20, and 25 Horse Power. All Engines Guaranteed for One Year.

JOHN J. GRIFFIN & CO.,

Nos. 1513, 1515, 1517 & 1519 Race Street, PHILADELPHIA.
52 Doy St., NEW YORK. 75 N. Clinton St., (FRED. R. PERSONS, Mangr.) CHICAGO.

MANUFACTURERS OF

METERS FOR MEASURING GAS

IN ANY VOLUME.

Provers, Gauges, Registers, Etc., Etc.

EXPERIMENTAL APPARATUS FOR QUANTITATIVE AND QUALITATIVE ANALYSIS.

Careful and Prompt Attention paid to Repairing of all kinds of Meters and Apparatus.

Estimates Cheerfully Furnished.

Dry Gas Meters.

With 40 years' experience and the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

No. 153 Franklin Street, Boston, Mass.,

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity. .

Test and Experimental Meters, Pressure Registers, Pressure Gauges, Pressure and Vacuum Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Patent Cluster Lanterns for Street Illumination.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 197 Michigan Street.**
NEW YORK, 838 Broadway. **SAN FRANCISCO, 221 Front St.**
BOSTON, 92 Water Street, Rooms 21 and 22.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc. Etc.

"Success" and "Perfect" Gas Stoves.

A. HARRIS. E. L. HARRIS. J. A. HARRIS.

Established 1849.

HARRIS BROS. & CO.,

Twelfth and Brown Streets, Philadelphia.

Manufacturers of Wet and Dry Gas Meters,

STATION METERS, METER PROVERS,

EXPERIMENTAL METERS, SHOW OR GLAZED METERS.

Pressure and Vacuum Registers, Gauges, Photometers, Drip and Bell Pumps, Etc., Etc.

PROMPT ATTENTION GIVEN TO ALL ORDERS. METERS THOROUGHLY REPAIRED. ESTIMATES FURNISHED FOR STATION METERS OF ALL SIZES. CORRESPONDENCE SOLICITED.

GAS METERS. GAS METERS. GAS METERS.

GEO. J. McGOURKEY, Prest. WM. H. McFADDEN, Vice-Prest. (Phila.) WM. N. MILSTED, Gen. Supt. and Treas. (New York). WM. H. DOWN, Sec.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

Manufactories:
512 West 22d St., N. Y.
Arch & 22d Sts, Phila.

GAS STOVES.
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
177 Elm Street, Cincinnati.
244 & 246 N. Wells Street, Chicago.
810 North Second Street, St. Louis.
222 Sutter Street, San Francisco.

HELME & McILHENNY,

(Established 1848.)

GAS METER MANUFACTURERS,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

WET AND DRY GAS METERS. STATION METERS, EXPERIMENTAL METERS, METER PROVERS,

Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works.

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of **all makers.**

WM. WALLACE GOODWIN, President and Treasurer. E. STEIN, Vice-President. H. B. GOODWIN, Secretary and Superintendent.

THE GOODWIN GAS STOVE AND METER CO.,

Successors to W. W. GOODWIN & CO.

1012, 1014 & 1016 Filbert St., Phila., Pa. 113 Chambers St., N. Y. City. 44 & 46 Dearborn St., Chicago, Ills.

WALDO BROTHERS, Agents, 88 Water Streets, Boston, Mass.

MANUFACTURERS OF

DRY AND WET GAS METERS,

Station Meters (square, cylindrical, or in staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, etc., etc. Meter Provers (sizes 2, 5, and 10 feet), Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6, and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Center Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete. Also, Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

Manufacturers of the "SUN DIAL" GAS STOVES, for Cooking and Heating.

Goodwin's Improved Lowe's Jet Photometer. **Agents for Bray's Patent Gas Burners and Lanterns.**

Special attention to Repairs of Meters and all Apparatus connected with the business. All work guaranteed first-class in every particular. Orders filled promptly.

G. B. EDWARDS, Manager, New York. **S. S. STRATTON, Manager, Chicago.**

D. McDONALD & CO.,

GAS METER MANUFACTURERS.

(Established 1854.)

51 Lancaster St., Albany, N. Y. 34 & 36 West Monroe St., Chicago, Ill.

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS, PRESSURE GAUGES, ETC.

Also STAR GAS STOVES, RANGES, and HEATING STOVES.

We use only the very best materials, and employ the most skilled labor, and by our long experience (36 years) and personal supervision of every detail we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the State Inspector's Badge, and will be fully warranted by us. Our Annual and Calendar will be sent to Gas Companies upon application.

WM. WALLACE GOODWIN, President. E. STEIN, Vice-President. H. B. GOODWIN, Sec. & Supt. G. B. EDWARDS, Mang'r, New York. S. S. STRATTON, Mang'r, Chicago.

THE GOODWIN GAS STOVE AND METER CO.,

1012, 1014 & 1016 Filbert St., Phila., Pa. 113 Chambers St., N. Y. City. 44 & 46 Dearborn St., Chicago, Ills.

Agents, WALDO BROTHERS, 88 Water Street, Boston.

SOLE MANUFACTURERS OF THE

"SUN DIAL" GAS STOVES,

The Most Economical, Efficient, and Durable Gas Stove Made.

GAS COOKING STOVE, No. 8 C.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
27 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17½ in. wide.	15 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspleces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
31 in. high.	9½ in. high.	10 in. high.	21 in. long.	33 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.

"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6¼ inches diameter, 8 inches high. Consumption, 6 feet per hour at 1 in. pressure.

HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

¾ in. supply pipe should be used where the pressure is 1 in. or over.